

STRUCTURE OF THIS MICROCARD  
(BASIC INSTRUCTIONS)

A02 = How to use this microcard	1	2	3	4
			SIS	
A01 = Structure of microcard	A	***X*	X*XXX	XXXXX XXXXX *XXXX X
B01 = Trouble- shooting chart	B	*XXXX	XXXXX XXXXX XXXXX XXX	
	C	XXXXX	XXXXX XXXXX XXXXX XXX	
	D	XXXXX	XXXXX XXXXX XXXXX XXX	
	E	XXXXX	XXXXX XXXXX XXXXX XX	
	F	XXXXX	XXXXX XXXXX XXX	
	G	XXXXX	XXXXX XXXX	
	H			
	J			
	K			
	L			
	M			
N01 = Service information	N	*XXXX	XXXXX XXXXX XXX	*X XX*
		12345	67890 12345 67890	12345 678
			1 2	
				Index

N28 = Table of contents and  
publication information

- 1 = Special features
- 2 = Safety and precautionary measures
- 3 = Test equipment and tools
- 4 = Installation position of components

- a. Read from left to right.
- b. Title of micropicture (appears on each micropicture).

E16	Product/component/test step	
	Coordinate	

c. Limits of section

<u>==&gt;</u>	<u>&lt;==</u>	<u>&lt;==</u>	<u>=&gt; &lt;=</u>
Beginning	Mid-section	End	One-page section

A01		=> <=
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HOW TO USE THIS MICROCARD

Trouble-shooting instructions PKW-052

System: Motronic M 1.1

Descriptions, photographs, terminal designations  
and special features refer to the following vehicle:

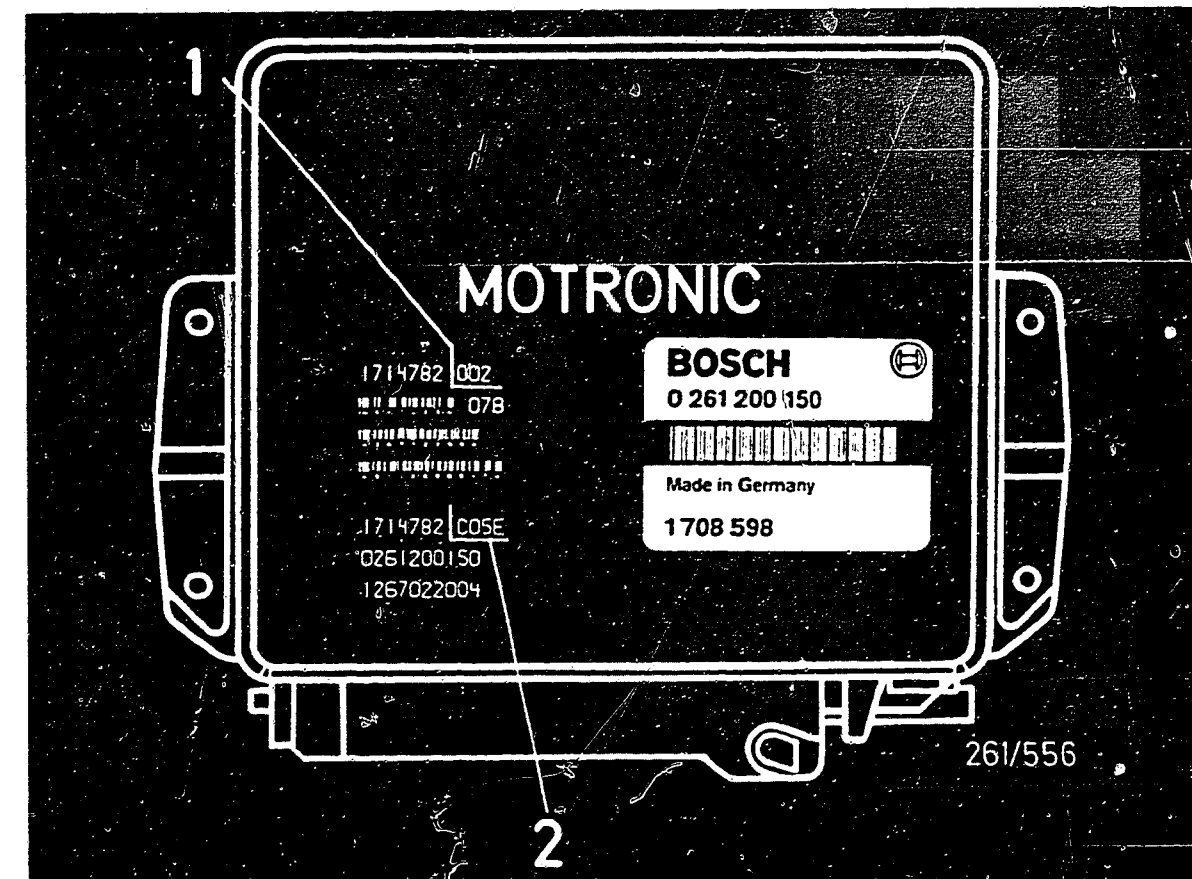
BMW 735i with 3.5-l engine, 6-cylinder,  
year of manufacture 10.86.->

These basic instructions comprise detailed  
trouble-shooting instructions. They must not  
be used as vehicle-specific instructions.  
Caution! Descriptions and photographs may  
deviate from the vehicle-specific brief  
instructions.  
Binding set values, terminal assignments and  
special features should be taken from the  
vehicle-specific brief instructions only.  
For brief instructions see microcard KFZ-00..

A02		=> <=
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## SPECIAL FEATURES

- \* Motronic system M 1.1 with self-diagnosis and flashing-code output.
- \* Variant code in control unit for adaptation to different types of fuel, to country-specific versions, to type of transmission and to vehicle model etc.
- \* Control unit with 55-pole plug.
- \* Joint sensor for engine speed and reference mark.
- \* Group injection: Breakdown into 2 groups which inject at different times.  
 Group 1: Cylinders 1, 3, 5.  
 Group 2: Cylinders 2, 4, 6.  
 Recognition via sensor on high-tension cable cylinder 6.  
 Note:  
 With cold engine and when accelerating, there is no breakdown into injection groups, but rather all injection valves inject simultaneously.
- \* Tank ventilation with clocked valve.
- \* Lambda closed-loop control.
- \* Injection valves with brass coils
- \* In-tank electric fuel pump



Control unit 0 261 200 150, old version  
FD 645 to 651.

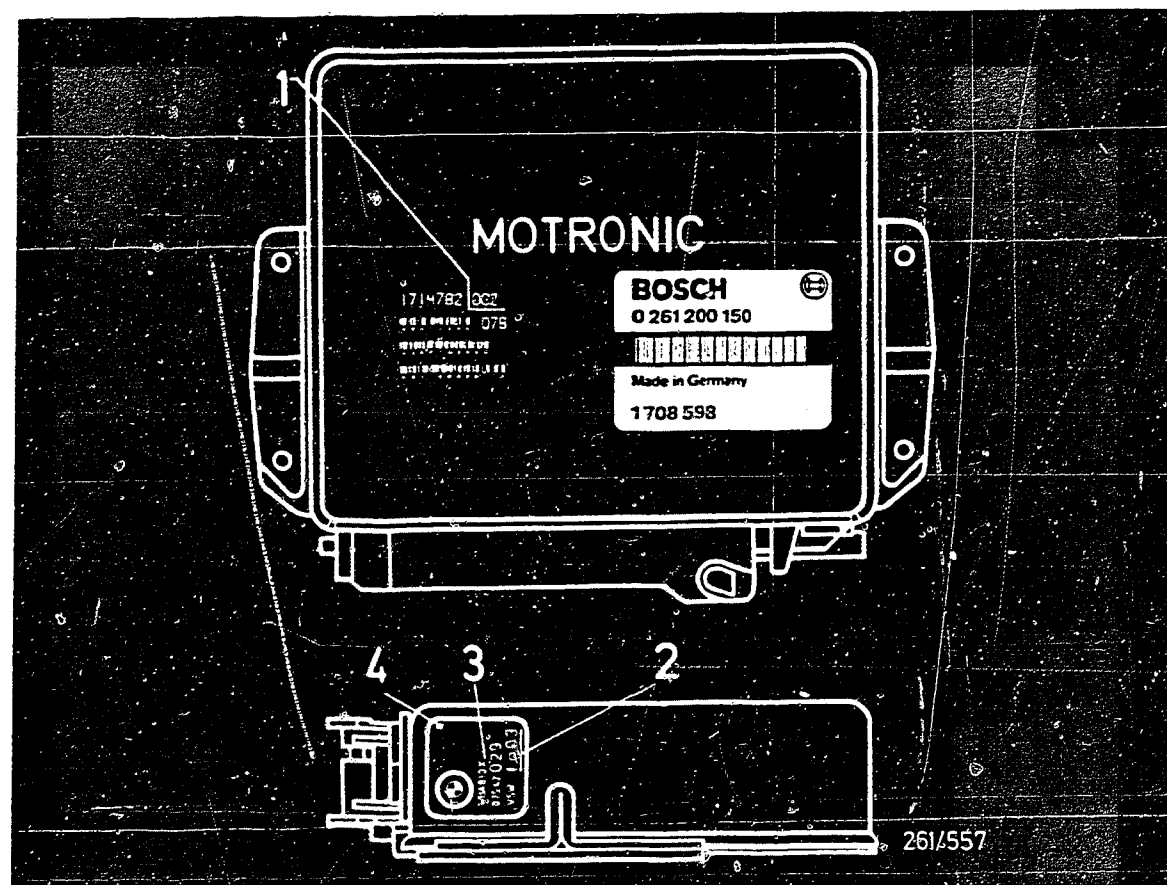
- 1 = Growth number, 3-digit
- 2 = Variant control word, 4-position, alphanumeric

### Variant-coded Motronic control units

When the new BMW 7 Series was introduced as of 10.86, a new type of control unit also entered series production.

The desired variant must be activated in a basic control unit in order to be able to adapt the engines to various types of transmission, to the model series, to different national versions and to differing fuel qualities and other special versions.

The object of this is to reduce the number of types of control unit.



Control units, new version as of FD 652

- 1 = Growth number, 3-digit
- 2 = Variant control word, 4-position, alphanumeric
- 3 = Chassis number
- 4 = BMW sticker

The new control-unit type must be programmed for the specific vehicle type **b e f o r e** delivery to the BG/BD at KH.

Note: the engine will not run with uncoded control units. Damage to the engine may occur with incorrectly coded control units.

Coding and programming can be carried out at KH only.  
To do this, KH requires the 10-digit part number for the basic control unit plus further information which is to be taken from the installed control unit.

The following information must be given when ordering:

- 1. Part number, 10-digit as before
- 2. Growth number, 3-digit (001 to 999)
- 3. Variant control word, 4-position, alphanumeric.

Example: 1. 0 261 200 150  
2. 002  
3. C05E

Delivery procedure:

+The variant-coded control units are carried at KH as central stock parts.

+Delivery by overnight despatch (within the Federal Republic of Germany) directly to the orderer.

+Delivery is extended by one day due to the necessary programming of the control units at KH.

## Tank ventilation system

Vehicles with lambda closed-loop control are equipped with a tank ventilation system.

The fuel vapors arising in the fuel tank are stored in the active-carbon filter. When the engine is running, the engine extracts the fuel vapors. A timed tank bleeder valve fitted between the active-carbon filter and the intake manifold meters the supply of fuel vapors.

Depending on the operating condition of the engine, the Motronic control unit controls the aperture cross section in the tank bleeder valve by way of the on-off ratio. This prevents the mixture change from being too great.

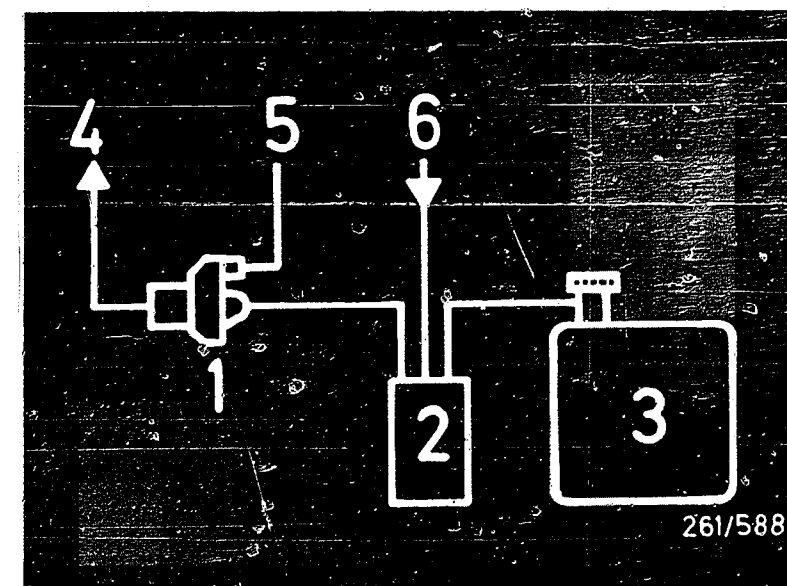
In the currentless condition with the ignition switched off, the tank bleeder valve is open. In order to prevent the engine from running on, the tank bleeder valve is released with a time delay after the ignition is switched off. This is made possible by a holding circuit fitted in the control unit.

### Holding circuit:

Previously, the main relay (term.86) was switched directly by the driving switch (term.15).

With the introduction of the holding circuit, the main relay (term.85) is switched by the control unit.

When the ignition is switched off, the holding circuit de-energizes the main relay with a time delay. The control unit thus remains active for a short time after switching off the ignition in order to keep the tank bleeder valve closed until the engine is at a standstill.



- 1 = Tank-ventilation valve
- 2 = Activated-carbon filter
- 3 = Fuel tank
- 4 = To intake manifold
- 5 = Electrical connection
- 6 = Air supply



## SAFETY AND PRECAUTIONARY MEASURES

Always observe safety and precautionary measures in order to avoid hazards to persons and damage to the engine, the trigger box and control unit, and the ignition system.

### CAUTION!

High-performance ignition system with dangerous high and low voltages!

Contact with voltage-carrying parts or terminals can be fatal (on both primary and secondary sides).

For compression test, detach main relay in order to prevent undesirable injection by injection valves and high-voltage flashovers.

Do not short-circuit ignition coil term.1 to ground (e.g. for stopping the engine). Ignition coil and possibly control unit shall be destroyed.

Never connect positive terminal of battery to ignition coil term.1. Control unit shall be destroyed.

When fitting an alarm system, following directions of installation instructions for Motronic vehicles or SIS microcard PKW 012. Ensure that the alarm relay is not disturbed by external fields (e.g. ignition cables) and therefore responds incorrectly.

## SAFETY AND PRECAUTIONARY MEASURES (continued)

Never start engine without battery being firmly connected (battery terminals bolted tight). Do not disconnect battery from the vehicle electrical system with the engine running.

Do not use a fast charger for starting the engine.

Render starting assistance only with a second 12 V battery and jumper cables.

Caution! Due to non-uniform requirements placed by vehicle manufacturers on electronic products, we do not recommend the use of 24 V batteries for starting assistance.

When charging the battery in the vehicle or rendering starting assistance, observe the directions given in the operating instructions of the fast charger as well as those provided by the vehicle manufacturer.

Prior to charging or fast-charging the battery, disconnect it from the vehicle electrical system.

Incorrect polarity of the supply voltage, e.g. due to incorrect connection of the battery or ignition coil, can lead to irreparable damage to a control unit.

Do not connect or disconnect the wiring harness from control units or trigger-box with the ignition switched on.

Prior to exposure to temperatures above +80°C (paint-dry installation) remove control units.

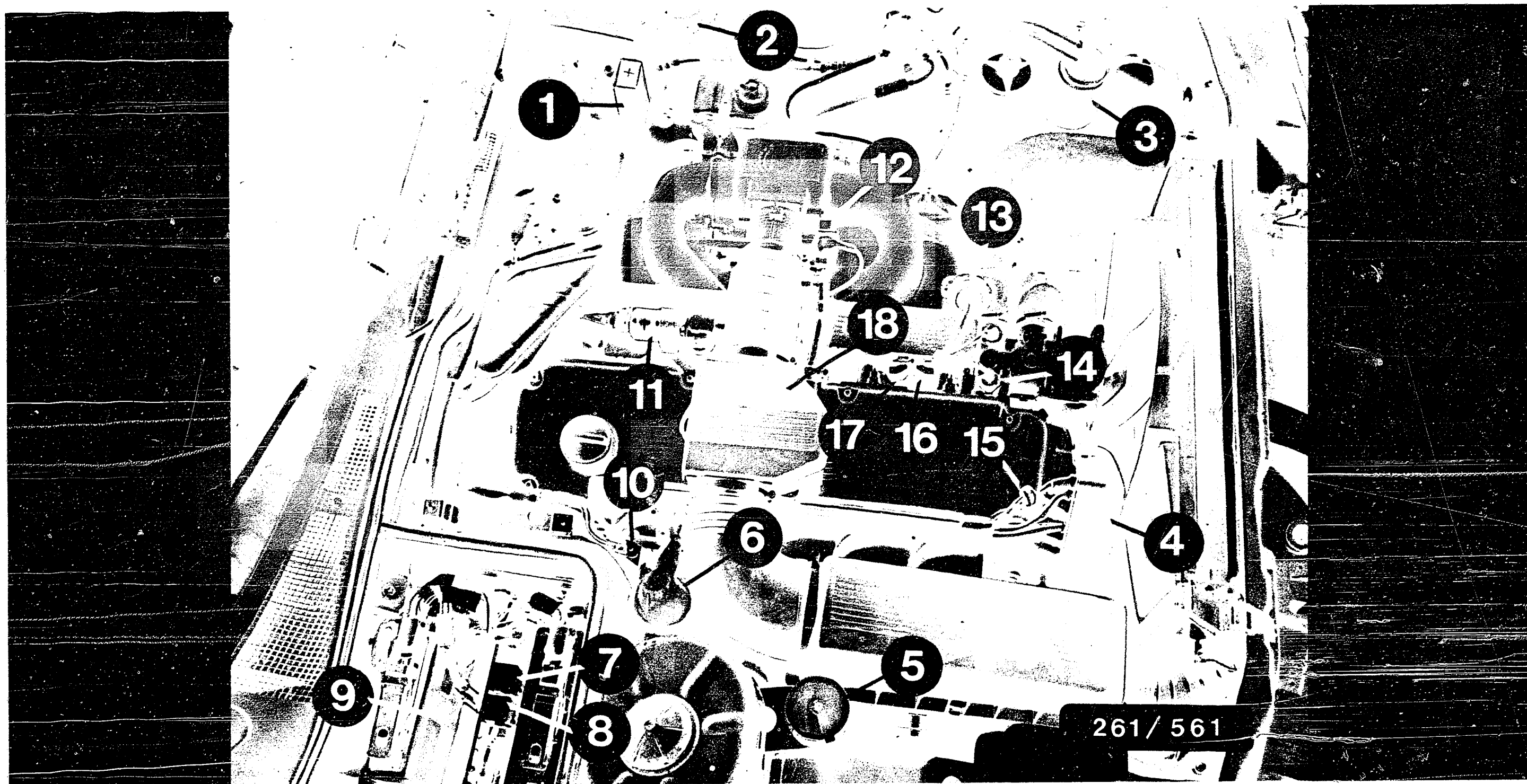
Control units must be removed before electric spot welding.

## TESTERS AND TOOLS

Name	Designation	Part No.
Motortester	e.g. MOT 201	0 684 000 201
	MOT 300	0 684 000 300
	MOT 400	0 684 000 400
Diagnosis cable for measuring spark-advance angle		1 684 463 196
Exhaust-gas analyzer	e.g. ETT 008.02	0 684 100 802
	or ETT 008.03	0 684 100 803
Multimeter (Internal resistance at least 20 k $\Omega$ /V)	e.g. MMD 301	0 684 500 301
Pressure gauge 6 bar	Quality class 1.0	1 687 231 154
	Scale divisions 0.1 bar	
or		
Pressure gauge		KDJE-P 100
or		
Pressure gauge (no longer available)		KDEP 1034
Three-way line as connection piece for KDJE-P 100 and KDEP 1034		KDJE-P 100/13
Evaluation unit for self-diagnosis flashing code		KDAW 9980

## TEST EQUIPMENT AND TOOLS (continued)

Description	Part no.
Feeler gauge for measuring sensor air gaps (up to 1 mm)	Commercially available
Lubricant for engine-speed and reference-mark sensor	Molykote Longterm 2, commercially available
Chassis dynamometer e.g. LPS 96 or LPS 002	0 680 017 001 0 680 100 200
Test lead 2-pole, for measuring resistances and signals e.g. at injection valves	1 684 463 093
Test leads for correct connection of testers at component plugs	KDZS 0004 (2.8 mm wide)  KDZS 0005 (6.3 mm wide)
Mounting paste VS 14016 Ft for Lambda sensor and exhaust-gas screw plug	5 960 080 105
Hose clamber for pinching off fuel and air hoses	Commercially available

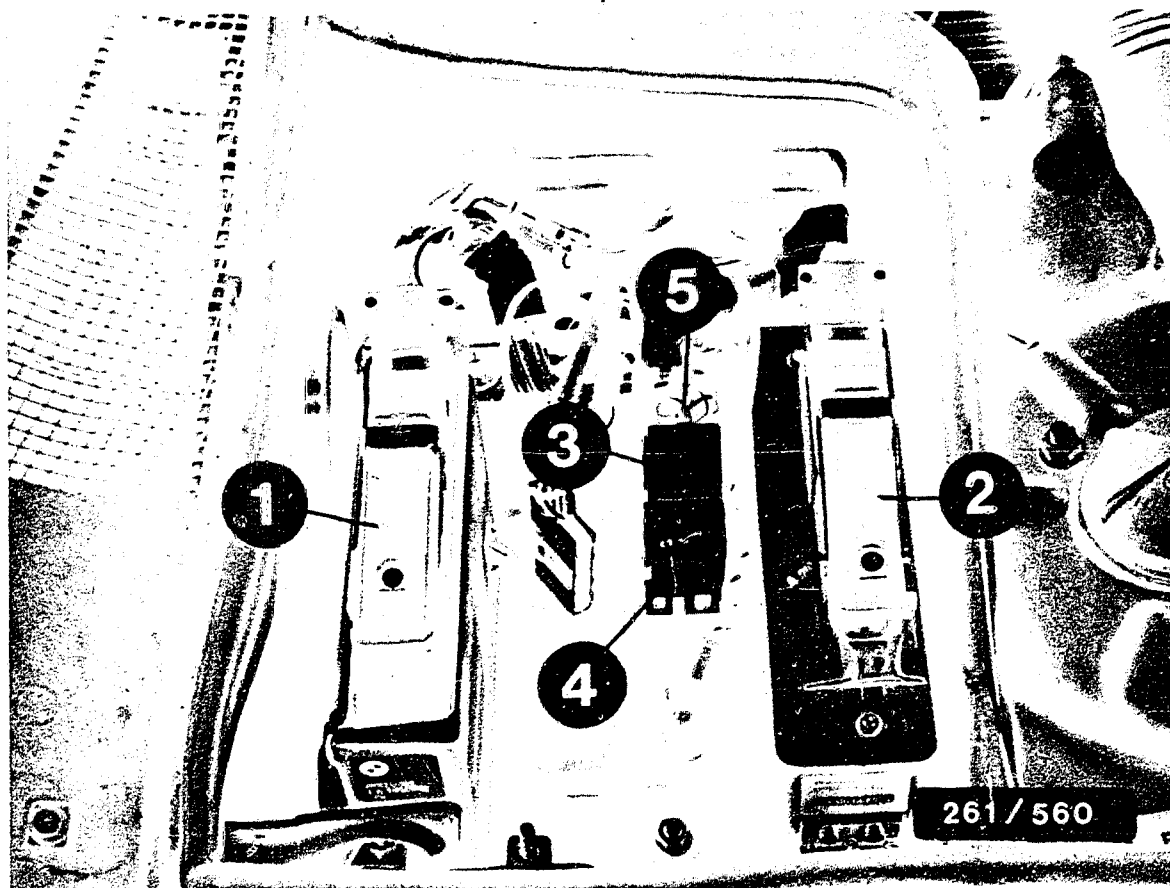


# INSTALLATION POSITION OF COMPONENTS

1 = Positive battery terminal  
 2 = Engine plug  
 3 = Active-carbon container (cat. only)  
 4 = High-tension distributor  
 5 = Diagnosis socket  
 6 = Ignition coil

7 = Main relay  
 8 = Pump relay  
 9 = Motronic control unit  
 10 = Motronic ground terminal  
 11 = Idle actuator  
 12 = Throttle-valve switch

13 = Fuel-pressure regulator  
 14 = Engine-temperature sensor  
 15 = High-tension sensor (cyl. 6)  
 16 = Plug, high-tension sensor  
 17 = Plug, speed/ref. mark sensor  
 18 = Air-flow sensor



- 1 = Motronic control unit
- 2 = ABS control unit
- 3 = Main relay
- 4 = Pump relay
- 5 = Plug connection, if transmission control fitted

#### INSTALLATION POSITION OF COMPONENTS (1)

The installation position given is always as viewed from behind the vehicle.

##### Control unit:

In the instrument compartment beneath the hood (E box on the right-hand firewall). Unscrew cap.

##### Main relay:

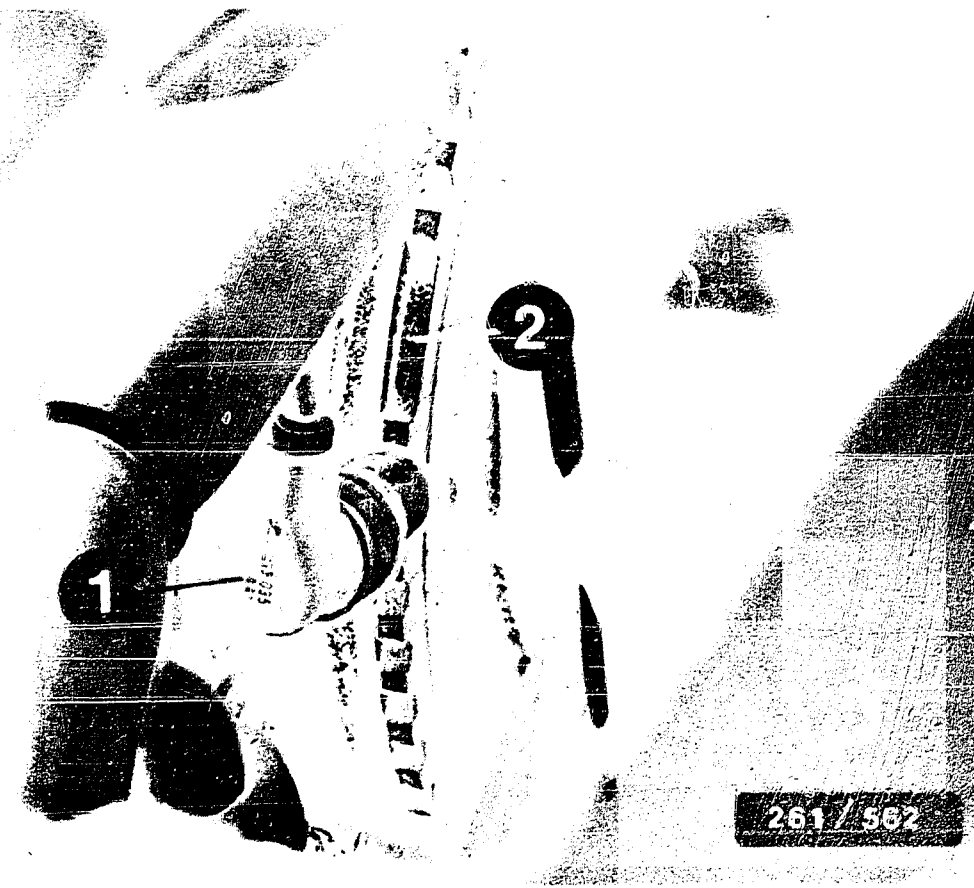
In the instrument compartment. White relay housing.

##### Pump relay:

In the instrument compartment. Orange relay housing.

##### Air-temperature sensor:

In the air-flow sensor.



- 1 = Engine-speed/reference-mark sensor
- 2 = Ring gear with gap

##### Electric fuel pump:

In the fuel tank.

##### Fuel filter:

Beneath the vehicle, in front of the fuel tank on the right.

##### Reference-mark/engine-speed sensor:

At front of engine, to the right of the crankshaft ring gear.

Plug connection between the injection valves of cylinders 1 and 2 (left-hand plug connection).

##### Ground terminal:

Next to the instrument compartment on the left, beneath a cap, close to the ignition coil.

### INSTALLATION POSITION OF COMPONENTS (3)

#### Lambda sensor:

In the common exhaust pipe (arrow, top picture). Round plug connection, 4-pin beneath the starting motor (arrow, center picture).

#### Tank vent valve:

Mounted on intake manifold in engine compartment, close to oil dipstick (arrow, bottom picture).

#### Fuse no. 23 for electric fuel pump:

In the fuse box on the left-hand firewall.

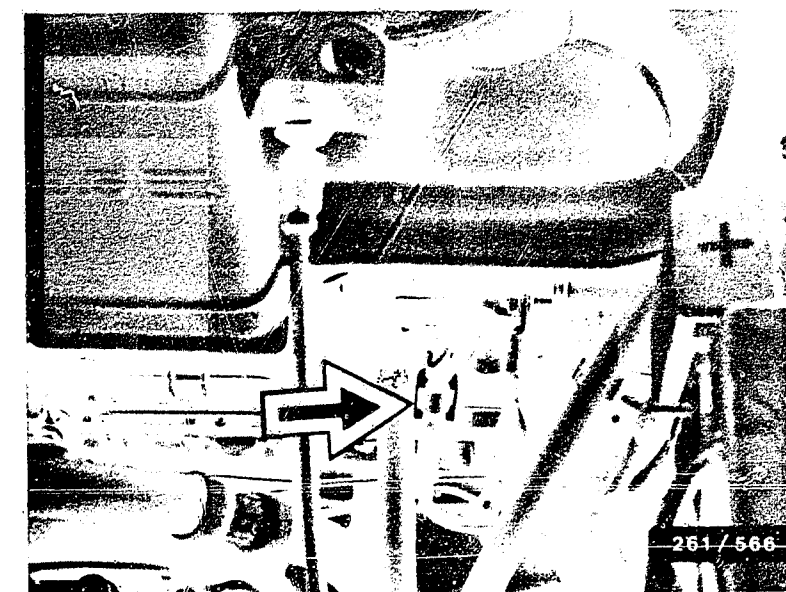
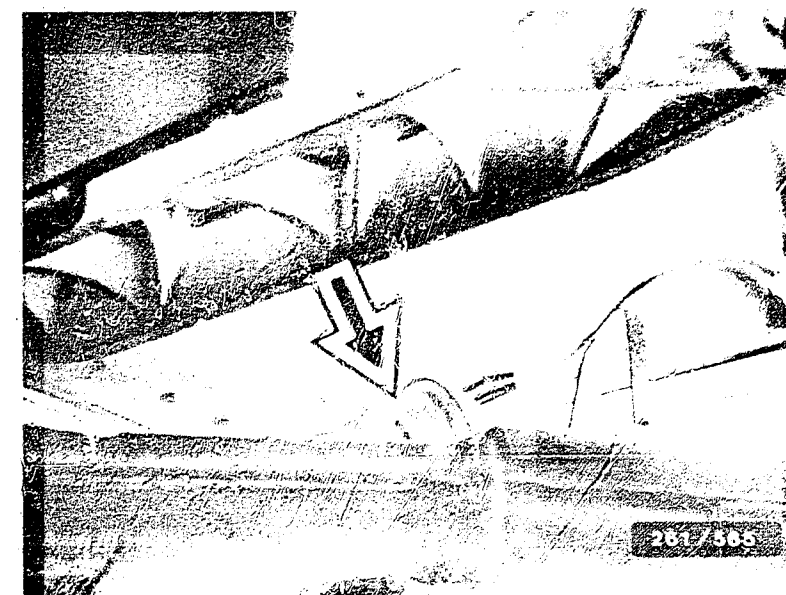
#### High-tension sensor:

On ignition cable for cylinder 6.

Plug connection between the injection valves of cylinders 1 and 2 (right-hand plug connection).

#### Battery:

Beneath the rear seat bench.



HOW TO USE TROUBLE-SHOOTING CHART AND  
TROUBLE-SHOOTING PROGRAM

The TROUBLE-SHOOTING CHART starts on  
Coordinate B03 and contains customer complaint  
(fault symptom) with several possible causes  
(component faults) in each case as well as  
coordinate references for detailed trouble-  
shooting. If no coordinate reference is given,  
it is a cause for which test instructions are  
not required.

Components that are checked by the self-  
diagnosis or with the universal test adapter  
are not listed in the trouble-shooting chart.

If the customer complaint is clear, proceed  
with trouble-shooting in the given order of  
possible causes, one after the other and step  
by step.

Trouble-shooting should always start with the  
self-diagnosis (if available) or with the  
universal test adapter (if provision is made).  
Only then continue with the trouble-shooting  
chart.

If the customer complaint is not clear, check  
all the causes given in the trouble-shooting  
chart. In order to prevent possible incorrect  
measurements, check all causes in the order  
given (because of the interlinking of test  
steps).

If the cause of the customer complaint has  
still not been eliminated after testing all  
possible faults, fit new prescribed ignition  
coil and/or trigger box/control unit.

HOW TO USE TROUBLE-SHOOTING CHART AND TROUBLE-SHOOTING  
PROGRAM (CONTINUED)

The TROUBLE-SHOOTING PROGRAM contains all  
system and component checks mentioned in the  
trouble-shooting chart. It is divided into  
three rows of boxes.

The left-hand column contains test instructions  
and set values.  
The center column contains instructions on trouble-  
shooting and fault rectification. The right-hand  
column contains the illustrations/terminal diagrams  
belonging to the text, with explanations.

If the questions in the left-hand column can be  
answered clearly with "yes", continue trouble-  
shooting with the next box down.

If the answer to the question is "no", branch  
to the center column and carry out the tests in  
the order given there.  
After the fault has been rectified, repeat the  
test as a check.

REQUIREMENTS FOR TESTING:

- Battery fully charged
- Engine in good mechanical condition  
(e.g. compression, valve clearance etc.)
- Engine at operating temperature, approx. +80°C  
(where necessary)
- Proper seating of all plug connections of  
wiring harness

## TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

												Cause (component fault)	Coord.
*	*	*	*	*	*	*	*	*	*	*	*	Self-diagnosis	B06
*												Voltage at control unit	C11D11
*												Engine-speed/reference-mark sensor	D17
*		*			*	*						Fuel pressure	D27E09
*		*			*	*						Solenoid op. inj. valves	E05
		*	*									Idle contact	E23
					*							Full-load contact	E27
	*	*	*	*	*	*						Air-flow sensor	E15
	*	*	*									Idle actuator	F11
*	*	*	*									Air intake system	F03
		*										Idle speed, CO	F25
*		*		*	*							Ignition coil	F17
*		*	*	*	*							Primary signal	F19
		*	*	*	*	*						Secondary pattern	F21
*	*	*	*		*	*		*	*			Ignition point	F23
*				*								High-tension sensor	F21
		*										Overrun cut-off	F15
		*	*	*								Interference-supp. resist.	F21
		*	*	*								Noise test	E19
					*							Interference	E07

**B03**

## TROUBLE-SHOOTING CHART (CONTINUED)

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

										Cause (component fault)	Coord.
				*				*		Throttle valve	E23
				*						Fuel delivery	E03
	*	*				*				Tank ventilation	A07F09
	*	*								Lambda closed-loop control	G01
*	*	*	*	*	*	*		*	*	Control unit	D11

**B04**



# USE OF SELF-DIAGNOSIS, SELF-DIAGNOSIS TEST TABLE, AND SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM

The control unit installed in this vehicle incorporates self-diagnosis. For this reason, trouble-shooting must start with self-diagnosis.

Activation of self-diagnosis is described starting on Co-ordinate B07. The self-diagnosis test table starting on B13 includes:

- Fault indication (flashing code)
- Components or system functions inspected
- Test instructions/conditions
- Connection terminals
- Set-value information
- Co-ordinate information for trouble-shooting and elimination in the subsequent self-diagnosis trouble-shooting program.

# USING THE SELF-DIAGNOSIS, SELF-DIAGNOSIS TEST TABLE AND SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (Continued)

The self-diagnosis trouble-shooting program is divided into three columns starting at Coordinate B19.

The left-hand column contains test instructions and set values.

The center column contains information on trouble-shooting and on how to rectify the fault.

The right-hand column contains the illustrations/terminal diagrams belonging to the text, together with explanations.

If the questions in the left-hand column can be answered conclusively with "yes", continue trouble-shooting with the next box down.

If the answer to the question is "no", branch to the center column and carry out the tests in the order given there.

After rectifying a fault, repeat the test as a check.

If the self-diagnosis indicates a fault, but no system fault or component fault was found during trouble-shooting, try replacing the control unit.

If no more fault is indicated in self-diagnosis and the customer complaint has still not been eliminated (symptom of trouble), continue trouble-shooting with the trouble-shooting chart starting at Coordinate B03.



### Connecting fault lamp and stimulation lead

In order to read out the flashing code, a fault lamp and a stimulation lead must be connected to the control-unit plug.

Connect the fault lamp to term. 15 and the stimulation lead to term. 43. The plug must not be detached from the control unit since otherwise the stored faults shall be deleted.

Opening the control-unit plug (see illustration):

Switch off ignition.

Slacken screws of strain-relief clamp and release screw on unlocking lever.

Hold down plug insert with suitable wire through the hole of the unlocking-lever screw.

Raise unlocking lever. Lift up plug housing until it can be detached from the mechanical coding. Push back plug housing over the wiring harness.

Do this carefully to ensure that the plug insert is not lifted off the control unit.

Prepare stimulation lead:

Use lead with 0.75 mm<sup>2</sup> and approx. 50 cm in length.

At one end attach a spring contact (Minitimer 2.3 mm).

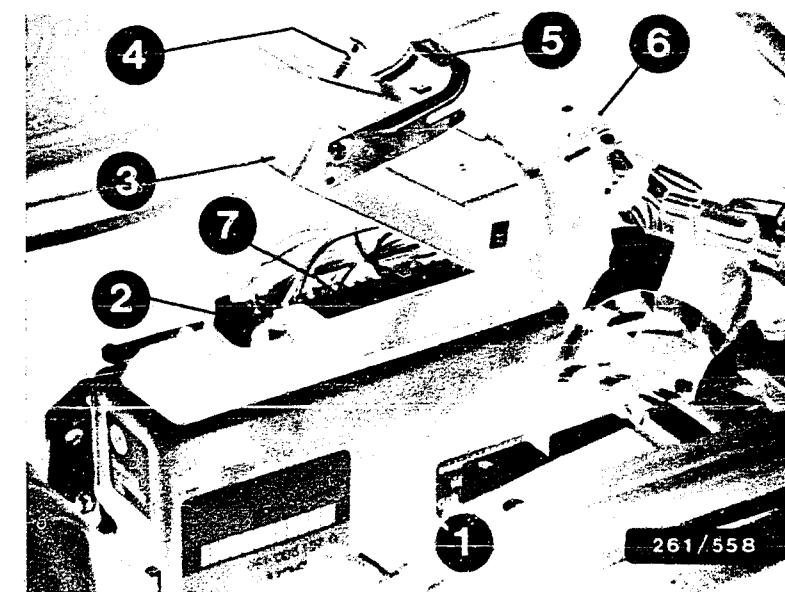
Connect a banana plug at the other end.

Connect stimulation lead in plug insert:

Using a small screwdriver, push back slide for locking the spring contacts (see bottom picture). Snap spring contact with stimulation lead into term. 43. Press slide back into locking position.

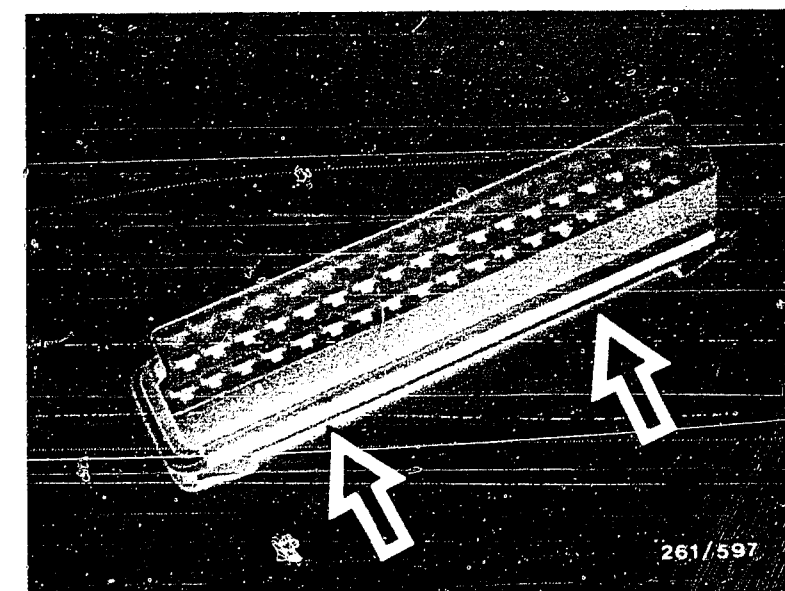
Connect fault lamp with max. 1.2 W (user-fabrication) to B+.

At the other end make contact with suitable test prod at term. 15 in control-unit plug.



- 1 = Motronic control unit
- 2 = Plug insert
- 3 = Plug housing
- 4 = Screw on unlocking lever
- 5 = Unlocking lever
- 6 = Strain relief
- 7 = Connection term. 43

Arrows=Sliders in plug insert



## How to activate the self-diagnosis

- + Switch on ignition.  
Wait min. 2.5 seconds before stimulation procedure.
- + Stimulation: Connect term.43 for 2.5 to 5 seconds to B+.
- + After the stimulation lead is opened the fault lamp lights up for approx. 2.5 seconds (starting pulse).
- + The actual fault output begins after the start pulse.

## Evaluate fault flashing code.

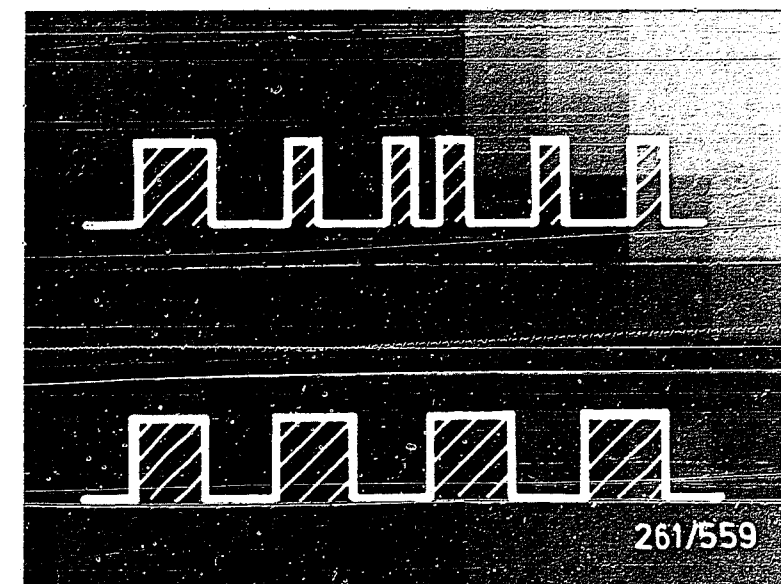
The flashing code for each fault comprises four flashing-pulse blocks. Each block represents a digit and contains between 1 and 9 pulses. One pulse corresponds to digit 1, 9 pulses correspond to digit 9. The fault lamp lights up briefly with each pulse. There is a longer interval between the blocks than between the individual pulses.

The flashing code word (e.g. 1215) in each case is repeated constantly. A pulse of approx. 2.5 seconds is issued to mark the boundary between the flashing code words.

Renewed stimulation causes the next fault to be output.  
Max. 5 faults may be stored.

## Possible flashing-code outputs after multiple stimulation.

- 1st stimulation    Fault output or no fault stored (flashing code process    : 4444 ).
- 2nd stimulation    Next fault is output, or if no further fault is stored "output end" flashing code appears (fault lamp lights up rhythmically with pulses approx. 2.5 seconds long).
- 3rd stimulation    When all faults are output (max. 5 faults) and process    : the last flashing code to appear was "output end" the fault lamp goes out or lights up permanently following a further stimulation process.



a = Fault code 1211  
b = Flashing code 0000  
    (output end)  
Shaded pulse area =  
fault lamp lights up

#### 4th stimulation process:

Possible to clear the fault memory.  
Can be cleared during the flashing code  
"output end" by executing the stimulation  
process for at least 10 seconds.  
The faults stored in the control unit are  
then deleted.

#### 5th stimulation process:

If a further stimulation process is executed,  
if the fault lamp has gone out or is lit up  
permanently (see 3rd stimulation process),  
fault output starts again from the beginning.  
If the faults are deleted, flashing code  
4444 appears (no fault stored).

#### Clearing the fault memory:

+ Stimulate for at least 10 seconds during  
flashing code "output end",  
führen.

Or:

+ Disconnect battery or control unit for at  
least 10 seconds.

Or:

+ Switch ignition off and on again at least  
5 times.

Self-diagnosis is terminated when the  
ignition is switched off.

For production reasons:  
continued on the following  
coordinate.

## SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Terminals	Set values	Coordinate
1 2 1 1	Control unit (memory contents)	Control unit defective.		—	B19
1 2 1 5	Air-flow sensor	<p>Check lead to term. 7 for open circuit, short circuit to ground or to positive (5 V or batt. +), and for contact with term. 12 and term. 26.</p> <p>Check leads to term. 12 and term. 26 for open circuit.</p> <p>Test resistances of air-flow sensor:  between term. 26 and term. 7 (deflect air-flow flap):  between term. 26 and term. 12:</p>	7,12,26	—          See brief instructions	B21
1 2 2 1	Lambda sensor (CAT only)	<p>Lead to lambda sensor open-circuited, short-circuited to ground or battery voltage.</p> <p>Watch for worn cable insulation!</p> <p>Sensor heater defective. Sensor clogged.</p>	28	—	B27
1 2 2 2	Lambda closed-loop control to rich or lean stop (CAT only)	<p>Test CO content.</p> <p>Test induction system for leaks.</p> <p>Test fuel pressure.</p> <p>Injection valves defective.</p>		See brief instructions	C01
1 2 2 3	Temperature sensor (coolant)	<p>Check temperature sensor and lead for open circuit and short circuit to ground.</p> <p>Temperature-sensor resistance:      at +15...+30°C :  at approx. +80°C :</p>	45	—   1450...3300 Ω 280... 360 Ω	C03

## SELF-DIAGNOSIS TEST TABLE

Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Terminals	Set values	See Coord.
1 2 2 4	Temperature sensor (intake air)	Check temperature sensor and lead for open-circuit and short-circuit to ground.  Temperature-sensor resistance at +15°C...+30°C:	44	See brief instructions	C07
1 2 3 1	Supply voltage for control unit with engine running	Supply voltage too low: Check voltage drops at positive and ground terminals. Charge battery.  Supply voltage too high: Check alternator regulator.	37(+), 19(-)	See brief instruc.  Less than 16 V	C11
1 2 3 2	Throttle-valve switch Idle contact	Fault: Idle contact permanently closed.  Idle contact closed in off-position: Depress accelerator slightly:	52	0 Ω infinity Ω	C15
1 2 3 3	Throttle-valve switch Full-load contact	Fault: Full-load contact permanently closed.  Full-load contact closed in full-throttle position: Release accelerator somewhat:	53	0 Ω infinity Ω	C19
1 2 5 1	Injection valves 1+3+5 and control unit (injection output stage)	Fault: Short-circuit to ground or to battery voltage or open-circuit in joint positive/negative lead.  Check lead and valves 1+3+5 for short-circuit/open-circuit; if O.K., control unit is defective.	16	See brief instructions	C23

SELF-DIAGNOSIS TEST TABLE (CONTINUED)

Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Terminals	Set values	See Coord.
1 2 5 2	Injection valves 2+4+6 and control unit (injection output stage)	Fault: Short-circuit to ground or to battery voltage or open-circuit in joint positive/negative lead. Check lead and valves 2 + 4 + 6 for short-circuit/open-circuit; if O.K., control unit is defective.	17	See brief instructions	C25
1 2 6 2	Idle actuator and ctrl.unit (output stage)	Fault: Short-circuit to ground or to battery voltage. Check leads for contact with ground or battery voltage; if O.K., control unit is defective. Winding resistances at +15...+30°C: between connection 1 and 2: between connection 3 and 2:	4, 22	See brief instructions	C27
1 2 6 3	Tank-ventilation valve and control unit (output stage) Note: CAT models only	Fault: Short-circuit to ground or to battery voltage. Check lead for contact with ground or battery voltage; if O.K., control unit is defective. Winding resistance at + 15°...+30° C:	5	See brief instructions	D03
1 2 7 8 *	Gear meshing	Fault: Short-circuit to ground. Check lead for short-circuit to ground or corresponding output in transmission control unit is defective.	51	—	D07
1 2 8 8	Fault lamp and control unit (lamp output stage)	Fault: Short-circuit to ground or to battery voltage.	15		D09

\* = Applies to motor vehicles with electronic transmission control (TC)

# SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM ( 1 )

## SELF-DIAGNOSIS FLASHING CODE 1211

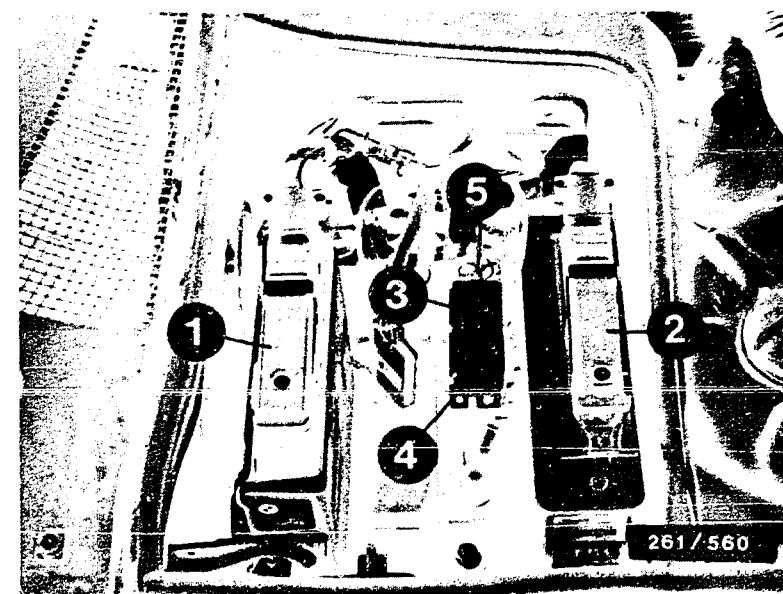
Check the digital section  
(program memory) in the  
control unit.

Flashing code not present?

N>

Replace control unit

Return to self-diagnosis  
test table B13



- 1 = Motronic control unit
- 2 = ABS control unit
- 3 = Main relay
- 4 = Pump relay
- 5 = Plug-in connection  
with transmission control

# SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM ( 2 )

## SELF-DIAGNOSIS FLASHING CODE 1215

Check air-flow sensor with ohmmeter.

Detach plug from air-flow sensor.

Measure resistance values directly at pins of air-flow sensor:

Set values between term.3 and term.4 and between term.2 and term.4 see brief instructions.

Are set values obtained?

N>

Replace air-flow sensor.

Carry out visual inspection on plug of air-flow sensor:

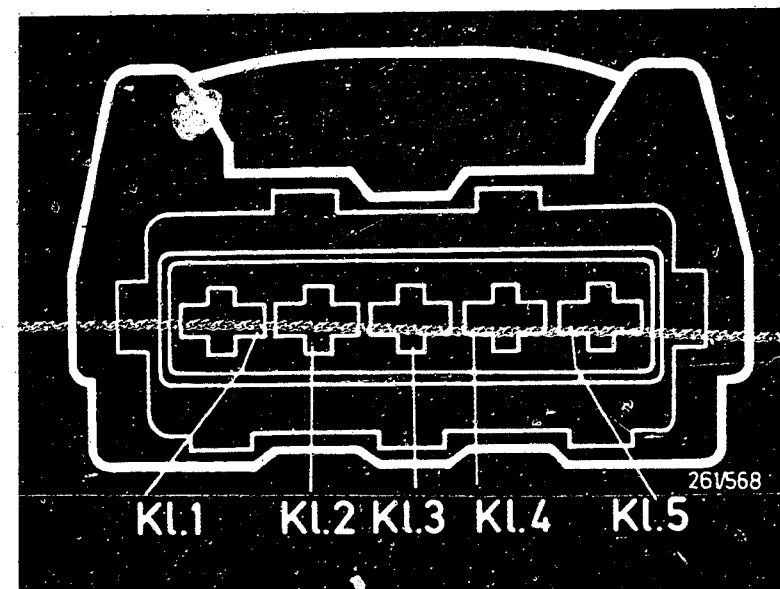
Plug inserted correctly, contacts corroded? Spring contacts must be latched in place and it must be impossible to push them back.

Is plug O.K.?

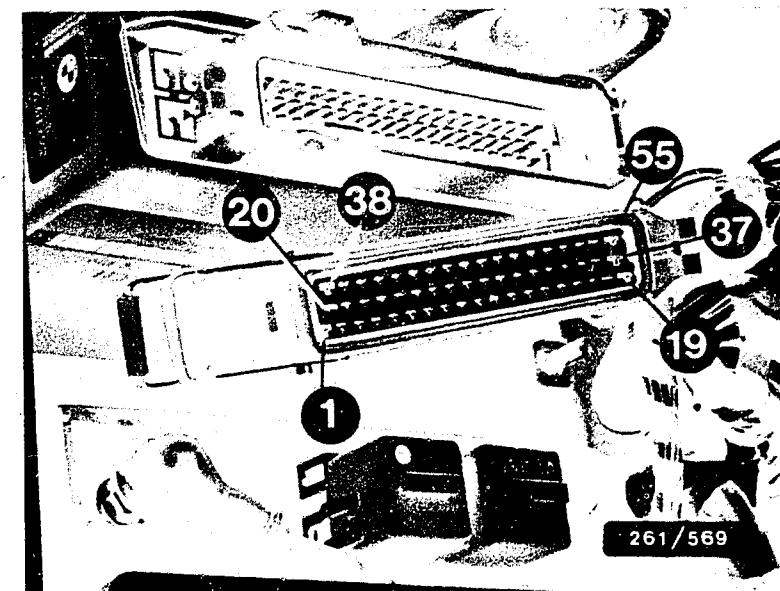
N>

Eliminate defects on plug. If necessary, replace plug or spring contacts.

Continued on next picture page



Top view of plug for air-flow sensor



Top view of 55-pin control-unit plug for Motronic wiring harness



# SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM ( 2 ) CONTINUED ( 1 )

Test leads from air-flow sensor to control-unit plug using ohmmeter for open circuit and short circuit to ground (insulation damage).

Air-flow to control-unit

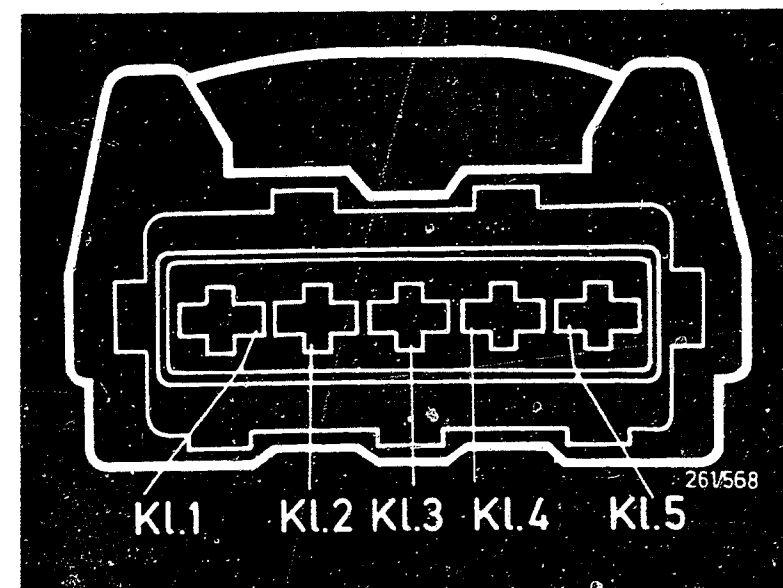
Term. 2	term. 7
Term. 3	term. 12
Term. 4	term. 26

Watch for damage to cable insulation and for loose contacts.

Leads O.K.?

N>

Eliminate contact resistances, open circuits and short circuits in leads.



Top view of plug for air-flow sensor

Test leads to control-unit plug term.12 and term. 26 for faulty connection to each other (short circuit).

For testing, disconnect plug from air-flow sensor.

Using ohmmeter, measure between the two terminals.

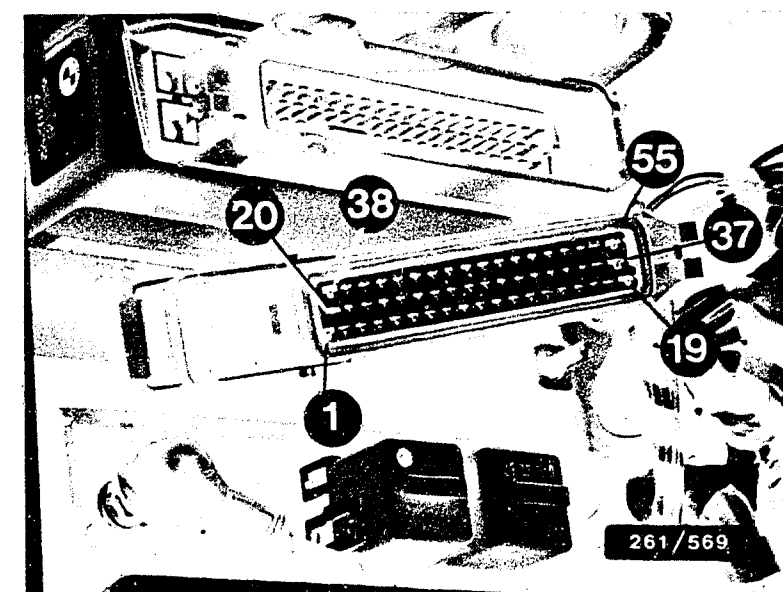
Watch for damage to cable insulation and for loose contacts.

Resistance value infinity  $\Omega$  ?

N>

Eliminate short circuit and damage to cable insulation.

Top view of 55-pin control-unit plug for Motronic wiring harness



Continued on next picture page

# SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM ( 2 ) CONTINUED ( 2 )

Additionally check leads from control unit, term. 26 and term. 7 to air-flow sensor, term. 2 and term. 4 for faulty connection to positive voltage:

Connect plug to air-flow sensor and control unit.

Push back rubber sleeve at plug of air-flow sensor.

Switch on ignition.

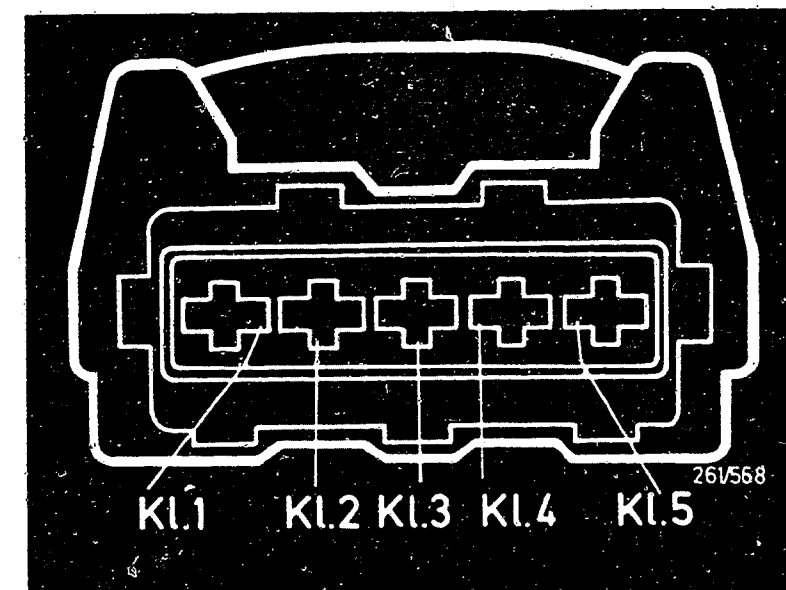
Connect voltmeter to ground and consecutively to term. 4 and term. 2 of air-flow sensor.

Set values:  
at term. 4 0 V  
at term. 2 < 4.5 V

Are set values attained?

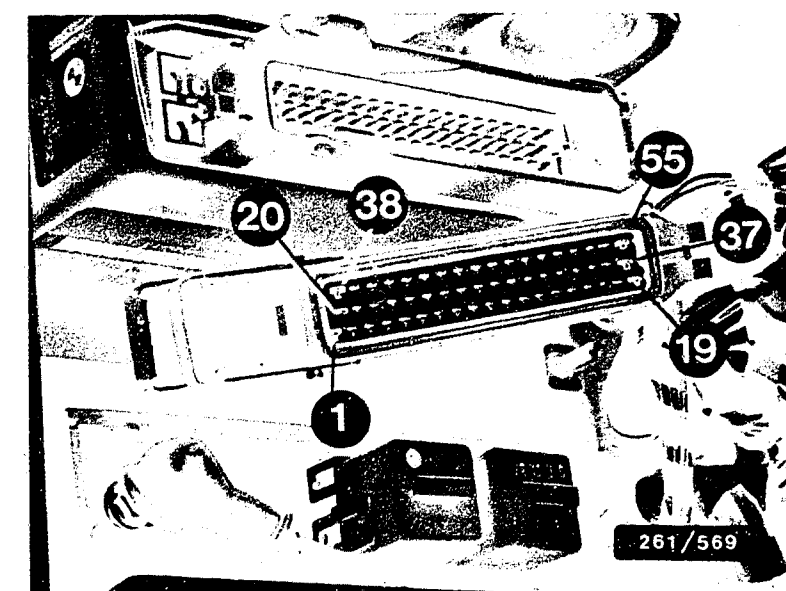
N>

- \* Visually check leads for contact (chafing points).
- \* Air-flow sensor defective.
- \* Control unit defective.



Top view of plug for air-flow sensor

Top view of 55-pin control-unit plug for Motronic wiring harness



Return to self-diagnosis test table B13

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM ( 3 )

SELF-DIAGNOSIS FLASHING CODE 1221

Lambda-sensor operation disrupted.

Using ohmmeter, test lead from control unit term. 28 to lambda-sensor plug-in connection (terminal 2) for open circuit.

Check plug for corrosion and loose contact. Contacts must not be able to be pushed back.

Check sensor heater.

Using ohmmeter, test lead from control unit term. 28 to lambda sensor for open circuit (contact) to ground. Watch for damage to cable insulation (insulation damage) and for loose contact.

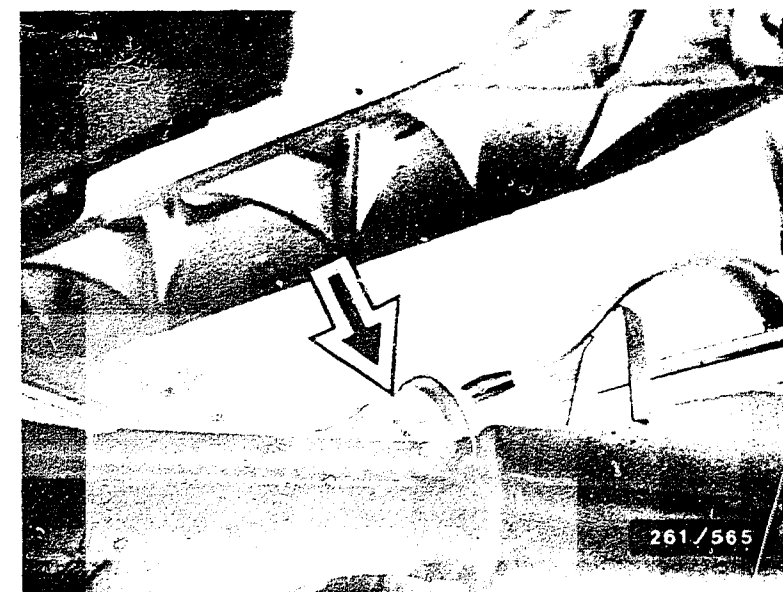
Lead from control unit term. 28 to lambda sensor is in contact with live lead (short circuit to battery voltage due to insulation damage).

Watch for damage to cable insulation and for loose contact.

Leads and plugs O.K.?

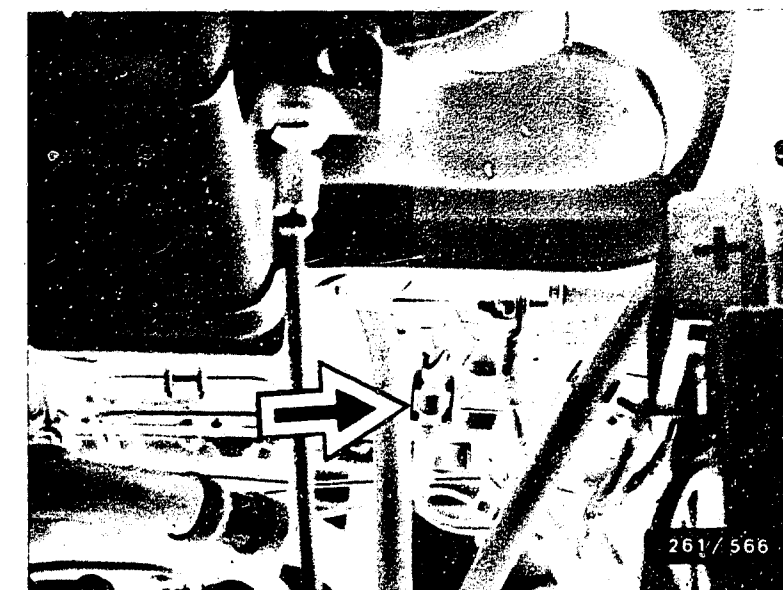
N>

Repair defective lead/plug.



Arrow = Lambda sensor

Arrow = Plug-in connection to lambda sensor (4-pin)



Replace lambda sensor. Flashing code now O.K.? 1221

N>

Replace control unit

Return to self-diagnosis test table B13

# SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM ( 4 )

## SELF-DIAGNOSIS FLASHING CODE 1222

Lambda closed-loop control  
on rich or lean stop.

Possible causes of fault:

- Leak in air intake system  
or exhaust system
- Fuel pressure and/or fuel  
delivery not within tolerance
- Defective injection valves
- Extreme incorrect setting  
of idle-mixture-adjusting screw.
- Air-flow sensor defective
- Tank ventilation defective.

Indicated items O.K.?

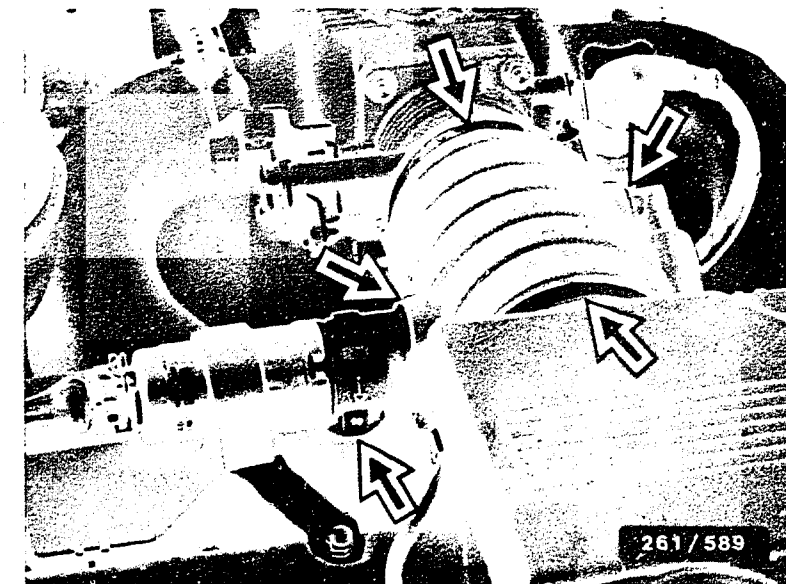
N>

Measure CO content ahead of catalytic  
converter (engine and catalytic  
converter at operating temperature):  
Set value: See brief instructions

1. If mixture too lean...
  - Check for leaks in air  
intake system and exhaust  
system.  
Eliminate leaks with new  
seals or by tightening  
fastening straps.
  - Deposits on injection  
valves
  - Fuel pressure and/or fuel  
delivery of electric  
fuel pump inadequate.  
See brief instructions  
for set values.
  - Extreme incorrect setting  
of idle-mixture-adjusting screw.
  - Tank empty or been  
empty.
  - Subject air-flow sensor to  
electrical and mechanical  
testing.
2. Mixture too rich.
  - Fuel pressure too high
  - Defective injection valves  
(leakage)
  - Defective tank-ventilation  
valve
  - Subject air-flow sensor  
to electrical and mechanical  
testing
  - Extreme incorrect setting  
of idle-mixture-adjusting screw.

Note :

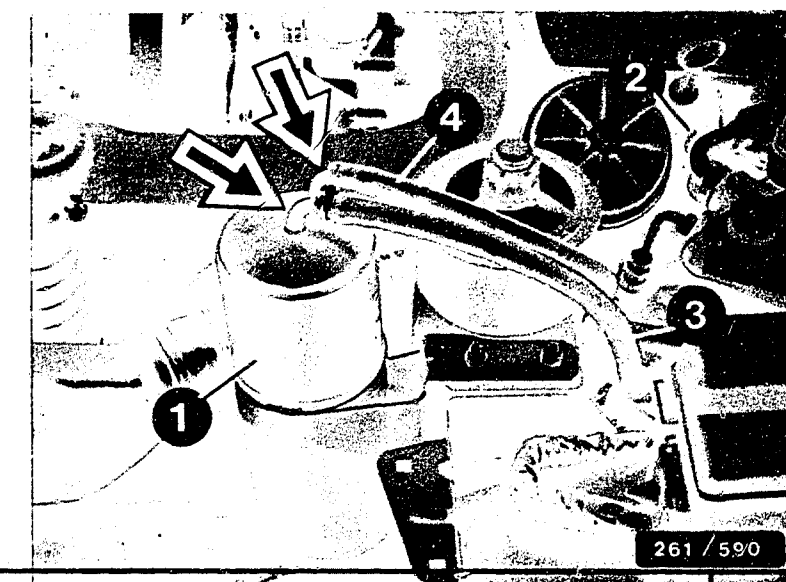
Mixture deviations in other  
engine operating statuses  
can cause the lambda closed-  
loop control to reach the  
stop even if the CO content  
is correct when idling.



Arrow = Sealing points of  
air-intake system

- 1 = Active-carbon canister
- 2 = Tank bleeder valve
- 3 = Bleeder hose  
(to tank)
- 4 = Hose to tank bleeder  
valve

Arrows = Sealing points on active-  
carbon canister



Return to self-diagnosis  
test table B13

# SELF-DIAGNOSIS TROUBLESHOOTING PROGRAM ( 5 )

## SELF-DIAGNOSIS FLASHING CODE 1223

Test coolant-temperature sensor:

Detach plug from temperature sensor.  
Test resistance value directly at pins of temperature sensor:

Set value:  
See brief instructions

Set value attained?

Renew temperature sensor.

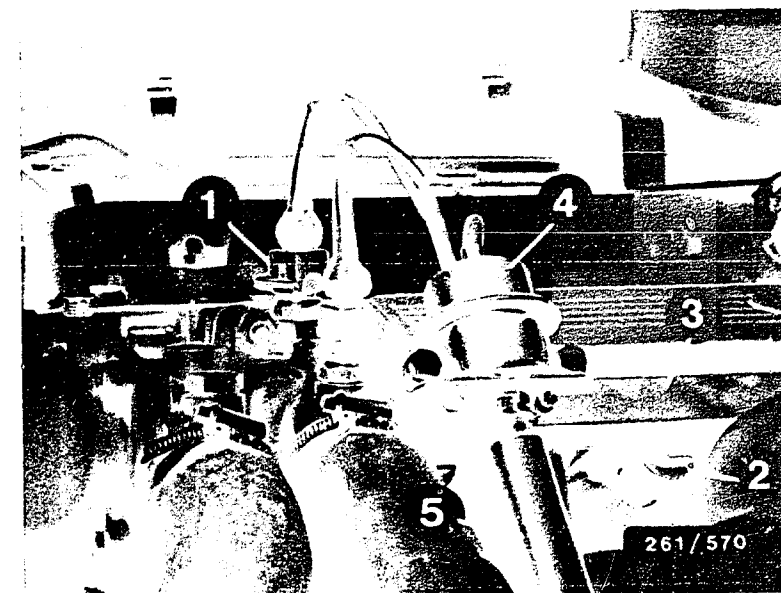
Visually inspect plug of temperature sensor:

Plug properly connected, contacts corroded? Spring contacts must be engaged and it must not be possible to push back the spring contacts.

Is plug O.K. ?

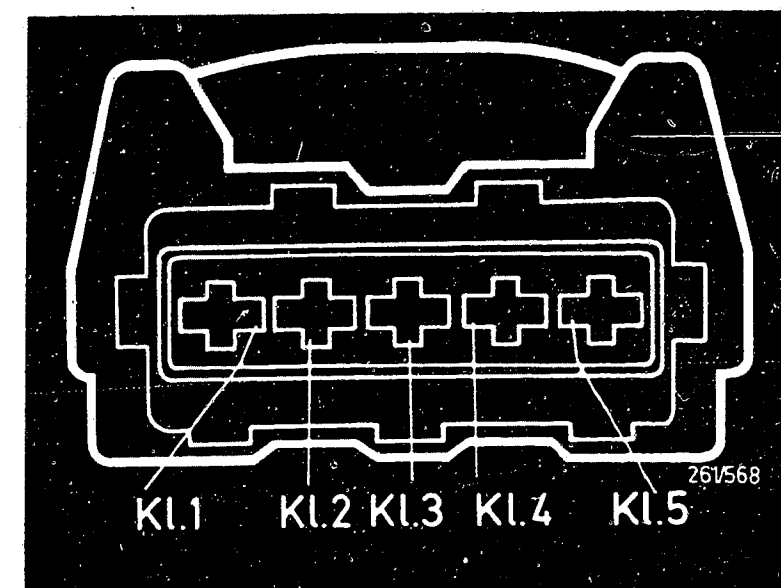
Eliminate defects on plug.  
If necessary, replace plug or spring contacts.

Continued on next picture page



- 1 = Coolant-temperature sensor
- 2 = Injection valve
- 3 = Fuel-distribution pipe
- 4 = Pressure regulator
- 5 = Return

Top view of plug for air-flow sensor



SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM ( 5) CONTINUED ( 1)

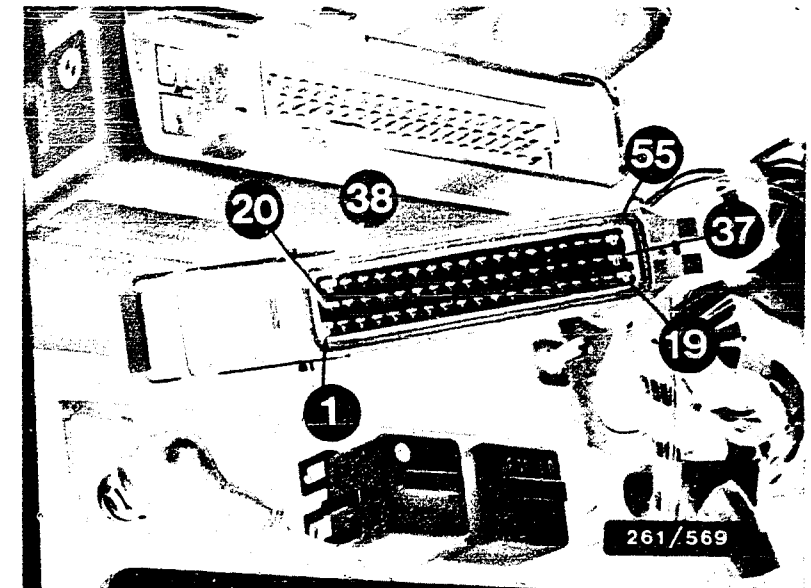
Check leads from  
temperature-sensor plug  
to control-unit plug  
term. 45 and to vehicle  
ground for open circuit  
and short circuit with  
ohmmeter.

Leads O.K.?

N>

Eliminate contact resistances,  
open circuits or short circuits  
on leads.

Return to self-diagnosis  
test table B13



Top view of 55-pin control-  
unit plug for Motronic  
wiring harness

# SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM ( 6 )

## SELF-DIAGNOSIS FLASHING CODE 1224

Check air-temperature sensor  
in air-flow sensor:

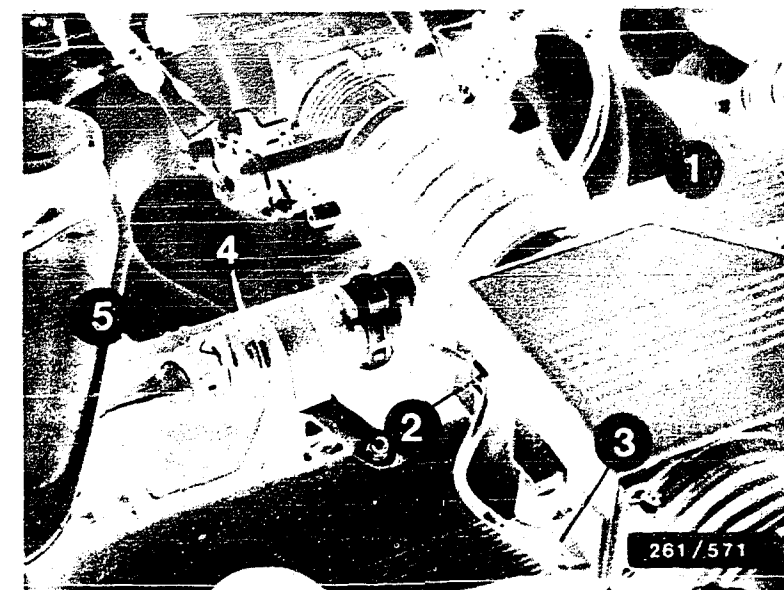
Detach plug from air-flow  
sensor.  
Check resistance value directly  
at air-flow sensor between  
term.1 and term.4:

Set value:  
see brief instructions

Is set value obtained?

N>

Replace air-flow sensor.



- 1 = Air-flow sensor
- 2 = CO adjusting screw
- 3 = Connector to  
air-flow sensor.
- 4 = Idle actuator
- 5 = Connector

Carry out visual check of  
plug of air-flow sensor.

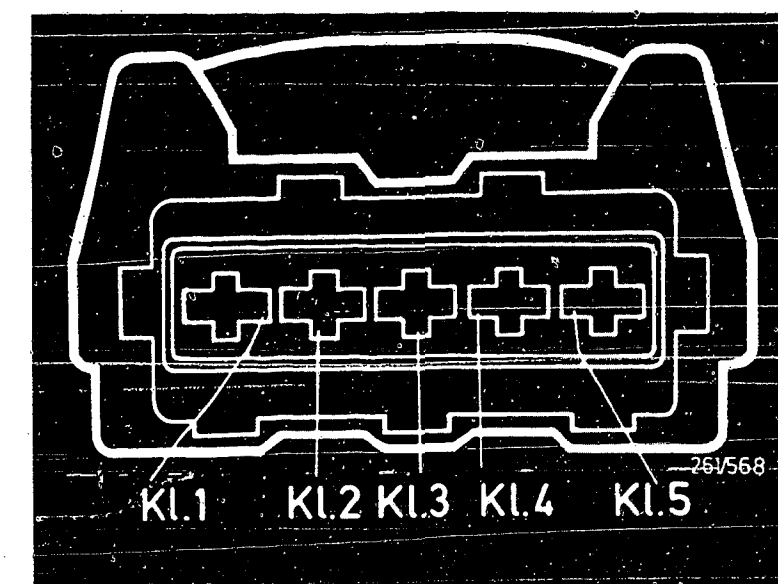
Plug inserted correctly,  
contacts corroded? Spring  
contacts must be locked in  
place and it must be  
impossible to push them back.

Is plug O.K.?

N>

Eliminate defects on plug.  
If necessary, replace plug  
or spring contacts.

Top view of plug for air-  
flow sensor



Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM ( 6 ) CONTINUED ( 1 )

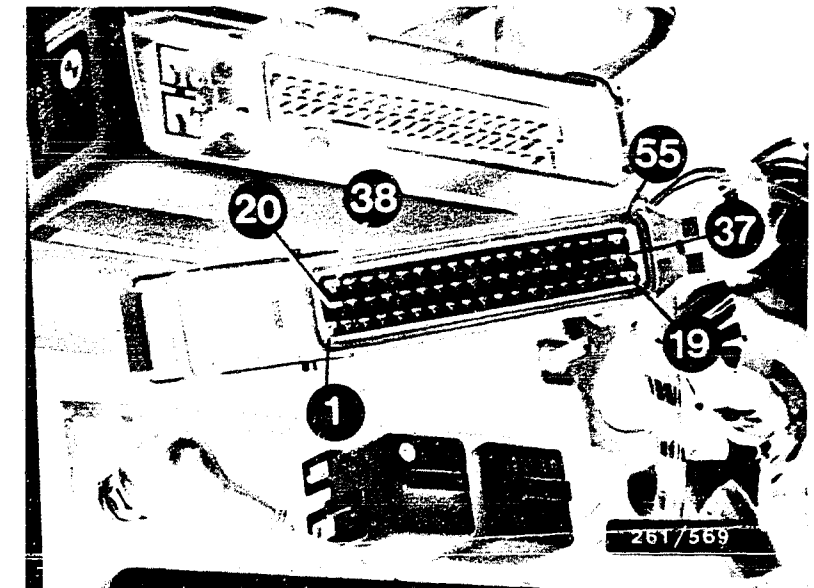
Check leads from air-flow-sensor plug term.1 and term.4 to control-unit plug term.44 and term.26 for open circuit and short circuit with ohmmeter.

Leads O.K.?

N>

Eliminate contact resistances, open circuits or short circuits on leads.

Top view of 55-pin control-unit plug for Motronic wiring harness



Return to self-diagnosis test table B13



# SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM ( 7 )

## SELF-DIAGNOSIS FLASHING CODE 1231

Fault:

Supply voltage at control unit term. 37 less than 10 V with the engine running.

Check voltage drops (contact resistances) at ground terminal and positive lead.

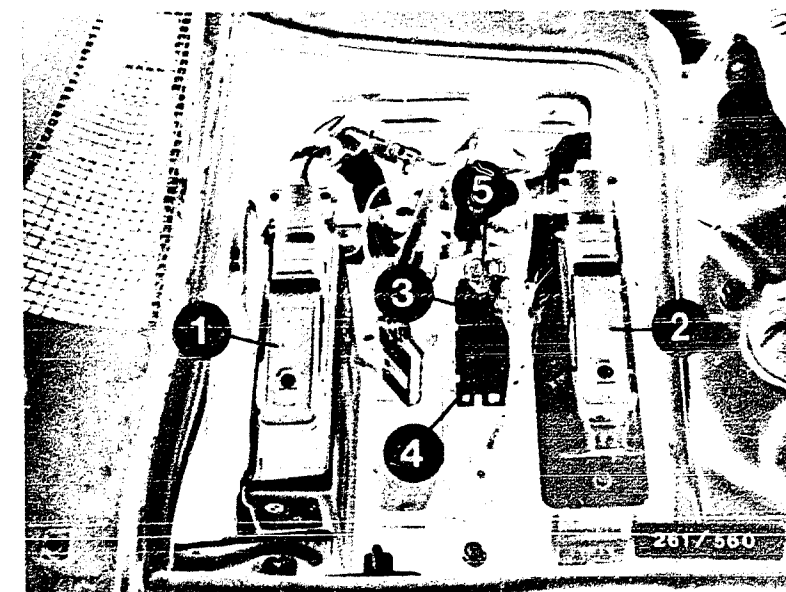
Terminals and plug-in connections must be bare and free of corrosion.

Positive terminals affected: at main relay term. 87 and term. 30 and at battery terminal B +.

Check main relay or try replacing it.  
Voltage drops eliminated?  
Relay O.K.?

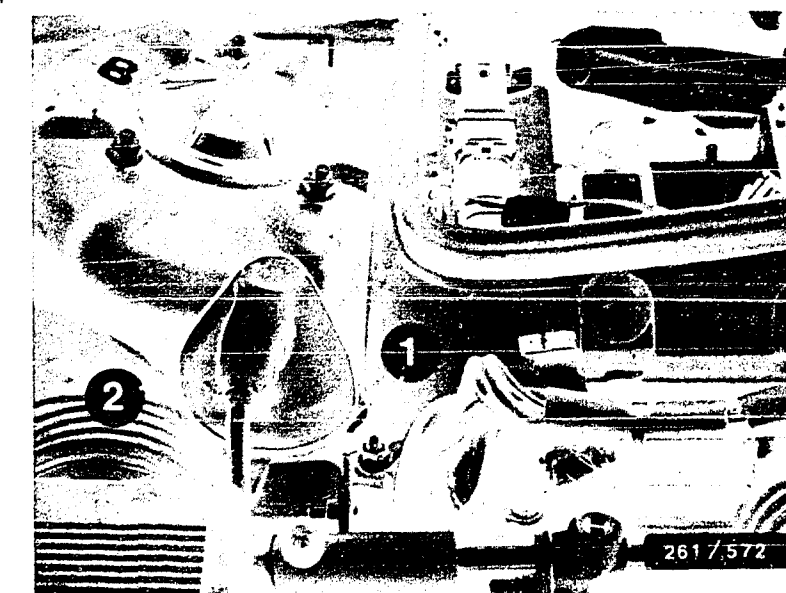
N>

Eliminate defects at terminals.  
If necessary, replace plug-in connections. Replace main relay.



- 1 = Motronic control unit
- 2 = ABS control unit
- 3 = Main relay
- 4 = Pump relay
- 5 = Plug-in connection with transmission control

2 = Ignition coil



Check state of charge of battery.

Battery sufficiently charged?

N>

Charge battery.

Return to self-diagnosis test table B13

C11

<=>

C12

<=>

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM ( 8 )

V

SELF-DIAGNOSIS FLASHING CODE 1231

Fault:  
Supply voltage at control  
unit term.37 higher than  
16 V with engine running.

Check generator regulator.

Generator regulator O.K.?

N>

Replace regulator.

Y

Return to self-diagnosis  
test table B13

# SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM ( 9 )

## SELF-DIAGNOSIS FLASHING CODE 1232

Idle contact in throttle-valve switch stays constantly closed or opens too late.

Check idle contact:  
Detach plug at throttle-valve switch.  
Throttle valve closed.  
Connect ohmmeter to throttle-valve switch term.2 (6)\* and term.18 (4)\*.

Set value: 0 ohms (continuity).  
Open throttle-valve slightly:  
Reading must change to infinite ohms.

Does resistance value change from 0 ohms to infinite ohms?

\*) Number in brackets applies to vehicles with electronic transmission control.

N>

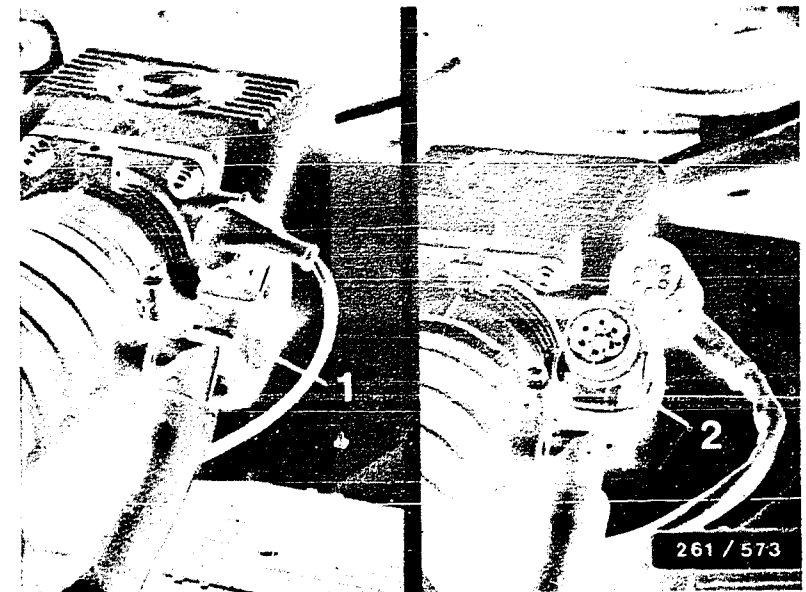
\*Resistance value stays at 0 ohms up to full-load stop (idle contact does not open):  
Replace throttle-valve switch.

\*Idle contact does not close (reading stays constantly at infinite ohms) or idle contact opens too late:  
Adjust throttle-valve switch.

\*Conditions for adjustment of throttle-valve switch:  
+throttle valve correctly adjusted? It must come up against the stop screw shortly before wedging with the lever. Lock screw to prevent maladjustment.  
+Adjust accelerator cable or linkage so that it is free of tension. If bent, replace.

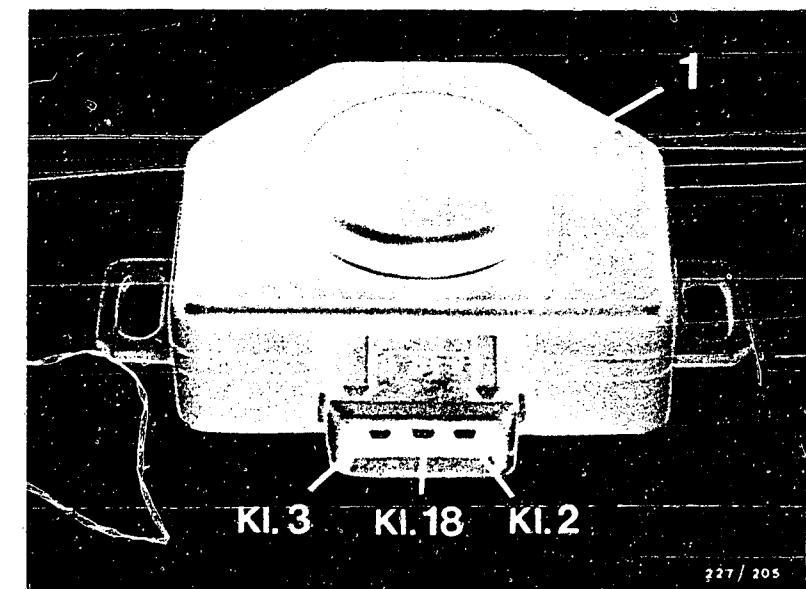
Adjusting the throttle-valve switch:  
Slacken fastening screws slightly. Connect ohmmeter at throttle-valve switch term.2 (6)\* term.18 (4)\*.  
Turn throttle-valve switch until idle contact closes (microswitch clicks audibly).  
Reading 0 ohms. If not, replace throttle-valve switch.

\* Numbers in brackets apply to vehicles with electronic transmission control.



- 1 = Throttle-valve switch with manually shifted transmission
- 2 = Throttle-valve switch (with pot) with electronic transmission control

- 1 = Throttle-valve switch in the case of manual transmission



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SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM ( 9 ) CONTINUED ( 1 )

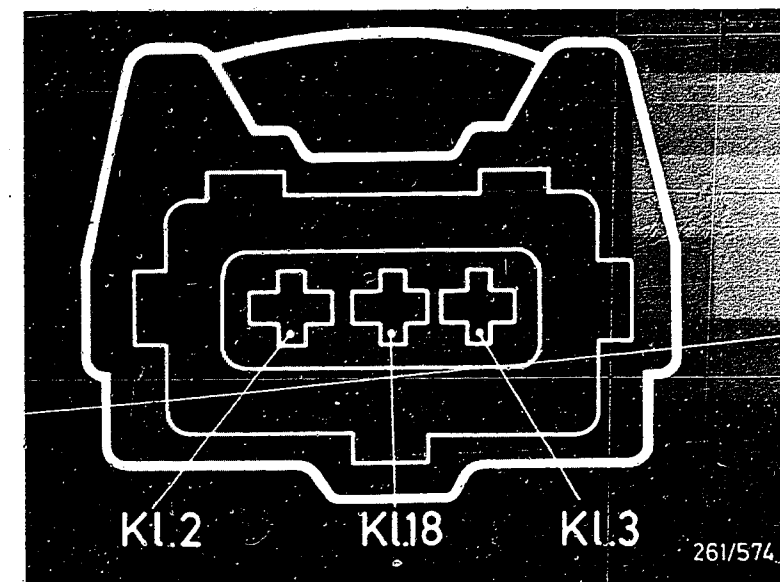
Checking the adjustment:  
Pull slightly on throttle  
cable. Idle contact must open  
(microswitch clicks audibly).

Reading: Infinity  $\Omega$

Eliminate short circuit on  
lead.

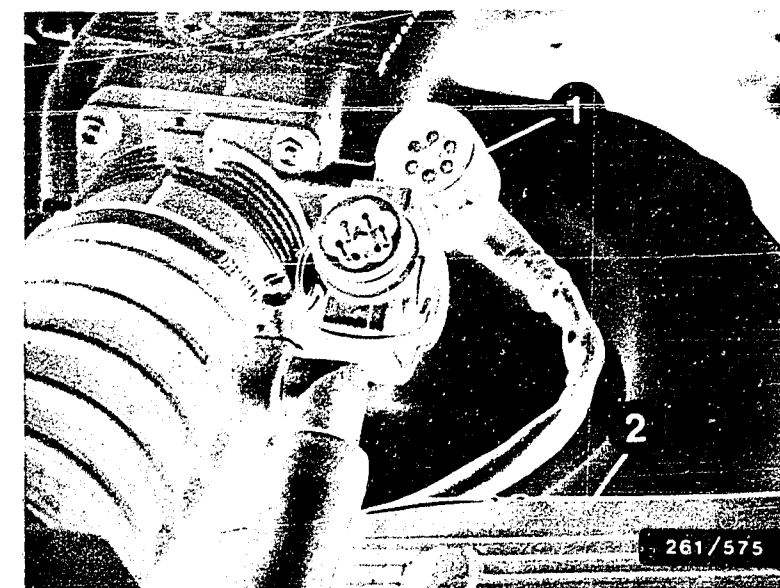
\*Check leads to throttle-  
valve switch for contact  
with each other and to  
ground:  
Detach plug from control unit  
and throttle-valve  
switch.  
Connect ohmmeter consecutively  
to plug of throttle-  
valve switch between  
term.2 (6) and term.18 (4)  
and then term.2 (6) and  
ground.  
Set value: infinite ohms in  
each case.  
Pay attention to chafing  
points and loose contacts.  
  
Are set values obtained?

Return to self-diagnosis  
test table B13



Throttle-valve-switch plug

- 1 = Throttle-valve-switch  
plug in vehicles with  
electronic transmission  
control  
(idle contact:  
term. 6 and term. 4)
- 2 = Cover over injection  
valves



# SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (10)

## SELF-DIAGNOSIS FLASHING CODE 1233

Full-load contact in throttle-valve switch stays constantly closed.

Check full-load contact:  
Detach plug from throttle-valve switch.  
Connect ohmmeter to throttle-valve switch term.3 (5)\* and term.18 (4)\*.  
Open throttle valve to stop:

Set value:  
Before the full-load stop is reached, the display changes from infinite ohms to 0 ohms.

Does the display change from infinite ohms to 0 ohms?

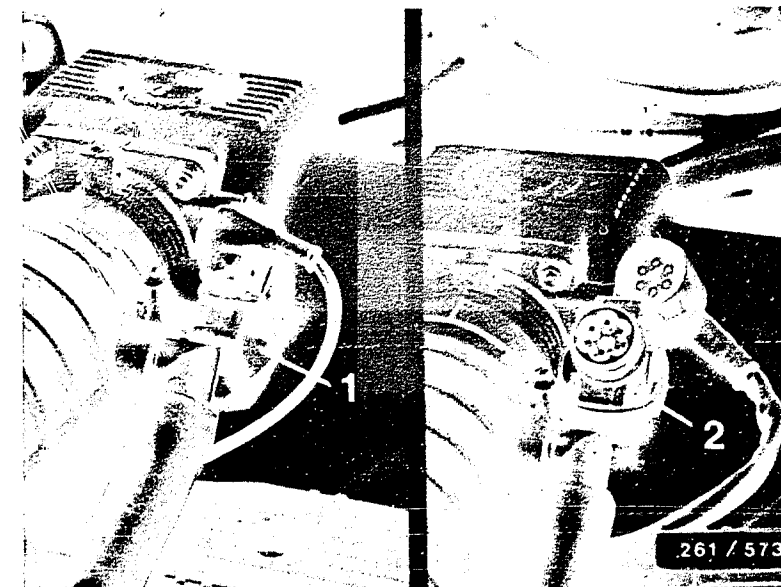
\* Number in brackets applies to vehicles with electronic transmission control.

N>

\* Resistance value remains constantly on approx. 0  $\Omega$  (full-load contact does not open):  
Replace throttle-valve switch.

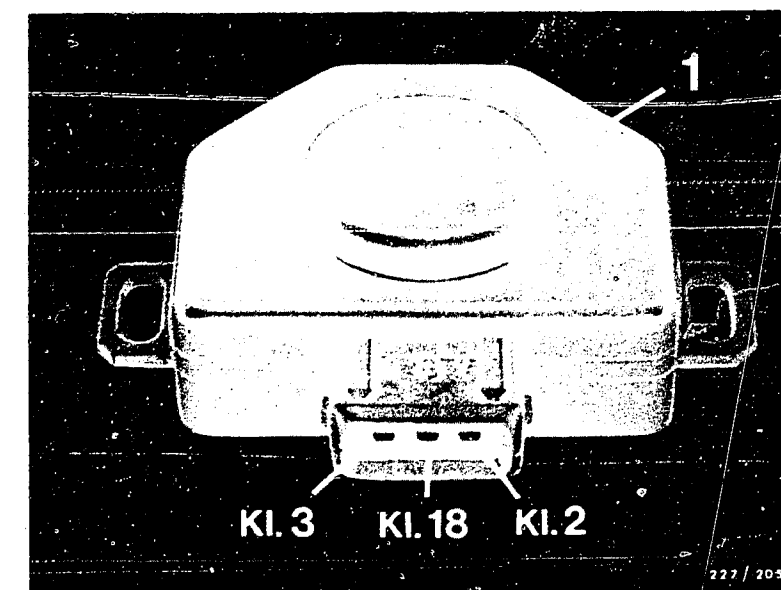
\* Full-load contact does not close (reading remains constantly on infinity  $\Omega$ ):  
Check whether throttle valve is mechanically capable of opening fully.  
If mechanical system is O.K., replace throttle-valve switch.

Note:  
Full-load contact cannot be adjusted. If idle contact is correctly set, then the setting of the full-load contact is likewise correct.



- 1 = Throttle-valve switch with manually shifted transmission
- 2 = Throttle-valve switch (with pot) with electronic transmission control

- 1 = Throttle-valve switch in the case of manual transmission



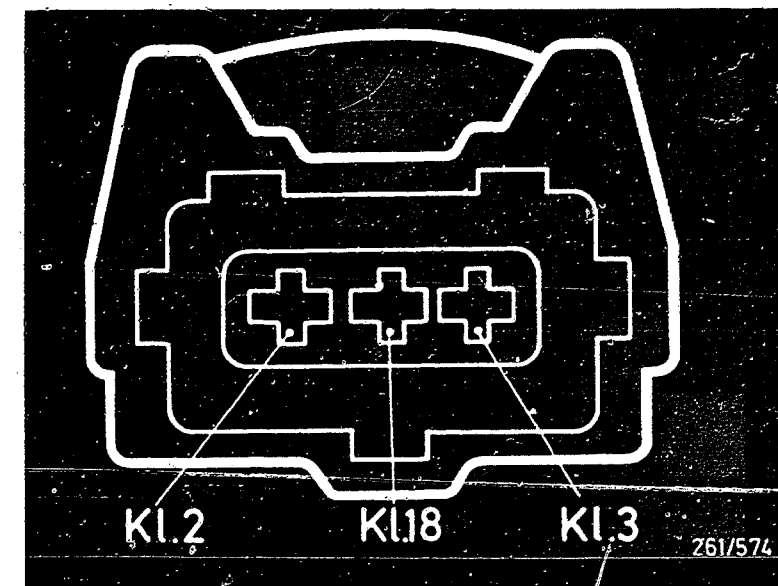
Continued on next picture page

# SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (10) CONTINUED ( 1)

\*Check leads to throttle-valve switch for contact with each other and to ground:  
Detach plug from control unit and throttle-valve switch.  
Connect ohmmeter consecutively to plug of throttle-valve switch between term.3 (5) and term.18 (4) and then term.3 (5) and ground.  
Set value:  
infinite  $\Omega$  in each case  
Pay attention to chafing points and loose contacts.

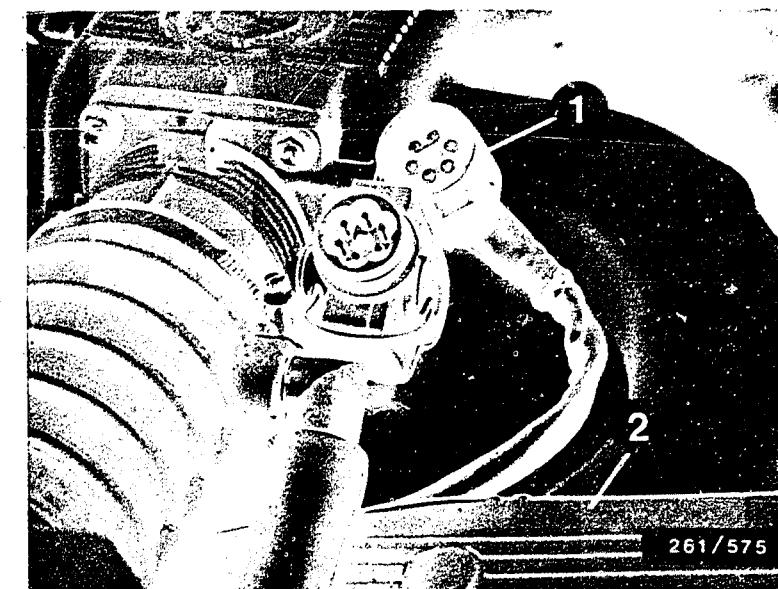
Are set values obtained?

Eliminate short circuit on lead.



Throttle-valve-switch plug

- 1 = Throttle-valve-switch plug in vehicles with electronic transmission control (full-load contact term.5 and term.4)
- 2 = Cover over injection valves



Return to self-diagnosis test table B13

# SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (11)

## SELF-DIAGNOSIS FLASHING CODE 1251

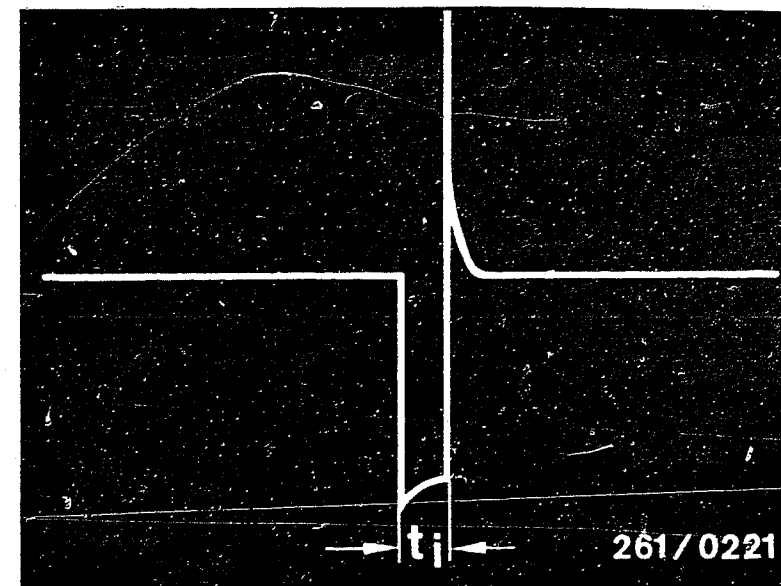
Injection valves cyl.1+3+5  
(Group 2):

- Check positive and ground leads to term.16 for open circuit, short circuit to ground and short circuit to positive. Watch for chafing points. Check crimped cable connector beneath cover for correct contact.
- Check injection-valve and control-unit plugs for correct contacting and corrosion. It must be impossible to push back spring contacts.
- Measure winding resistance of injection valves.  
Set value:  
see brief instructions
- Measure injection signal of group 2. (Measurement method is described in trouble-shooting program)..

Leads, plug-in connections,  
injection valves and signal  
O.K.?

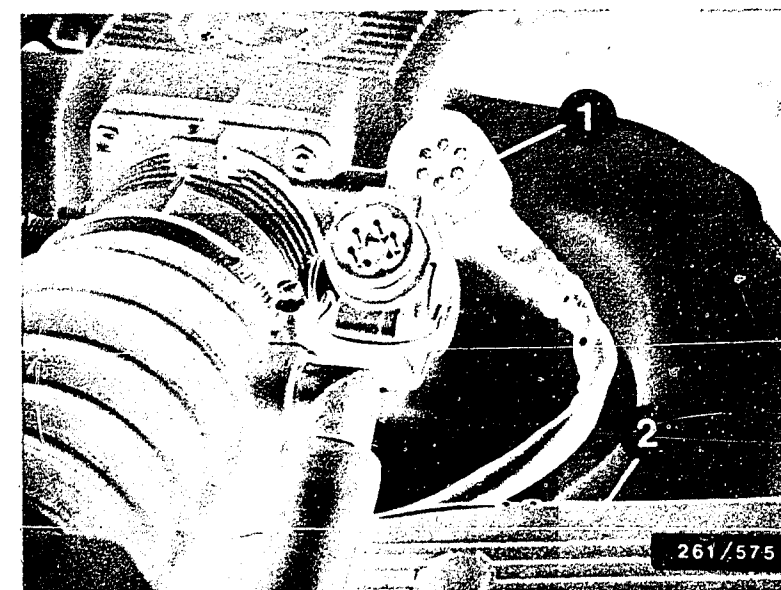
N>

- Rectify problems with leads and plug-in connections.
- Replace defective injection valves.
- If peripherals are O.K. and no injection signal is visible, replace control unit.



Injection signal  
 $t_i$  = Duration of injection

2 = Cover over injection  
valves



Return to self-diagnosis  
test table B13

# SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (12)

## SELF-DIAGNOSIS FLASHING CODE 1252

Injection valves cyl.2+4+6  
(Group 1):

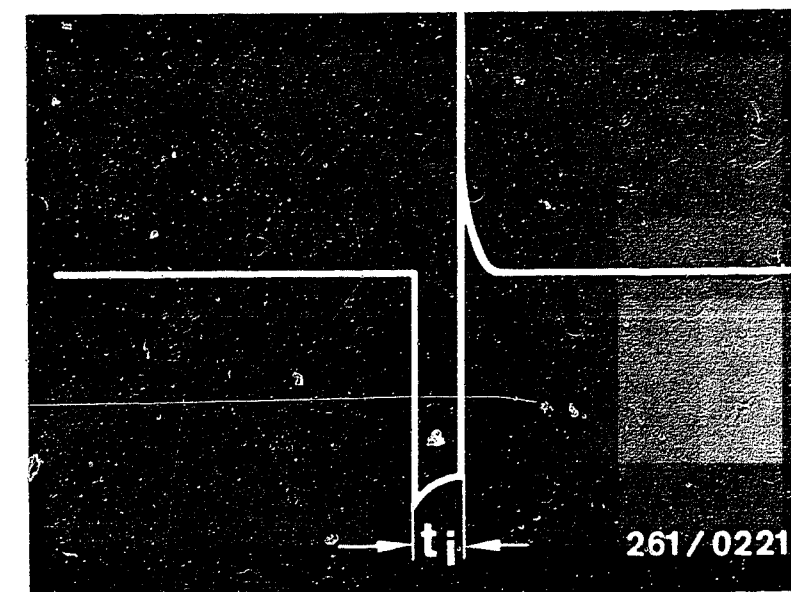
- Check positive and ground leads to term.17 for open circuit, short circuit to ground and short circuit to positive. Watch for chafing points. Check crimped cable connectors beneath cover for correct contacting.
- Check injection-valve and control-unit plugs for correct contacting and corrosion. It must be impossible to push back spring contacts.
- Measure winding resistance of injection valves.  
Set value:  
see brief instructions
- Measure injection signal of group 1. (Measurement method is described in trouble-shooting program.

Leads, plug-in connections, injection valves and signals O.K.?

N>

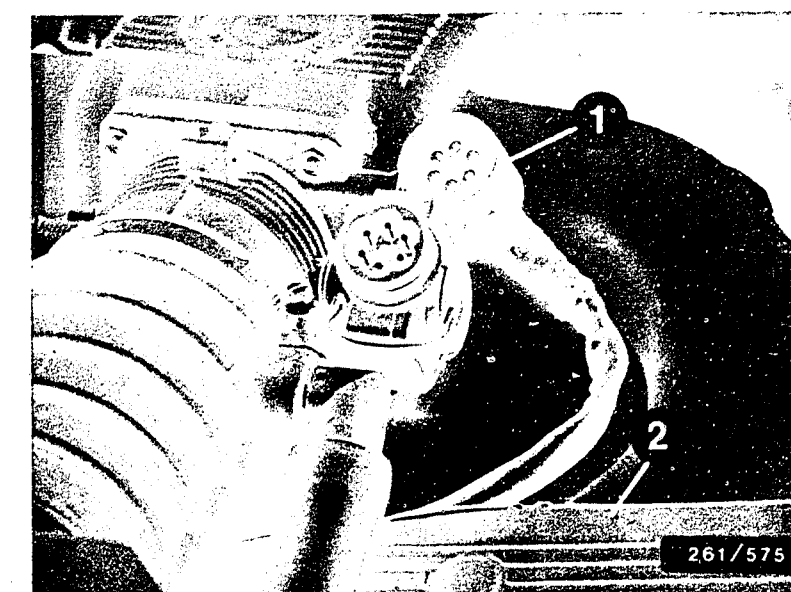
- Rectify problems with leads and plug-in connections.
- Replace defective injection valves.
- If peripherals are O.K. and no injection signal is visible, replace control unit.

Return to self-diagnosis test table B13



Injection signal  
 $t_i$  = Duration of injection

2 = Cover over injection valves





SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (13)

SELF-DIAGNOSIS FLASHING CODE 1262

Check idle adjuster:

Detach plug from idle  
adjuster.  
Check resistance value  
directly at pins of idle  
adjuster.

Set value:  
see brief instructions

Is set value obtained?

Replace idle adjuster.

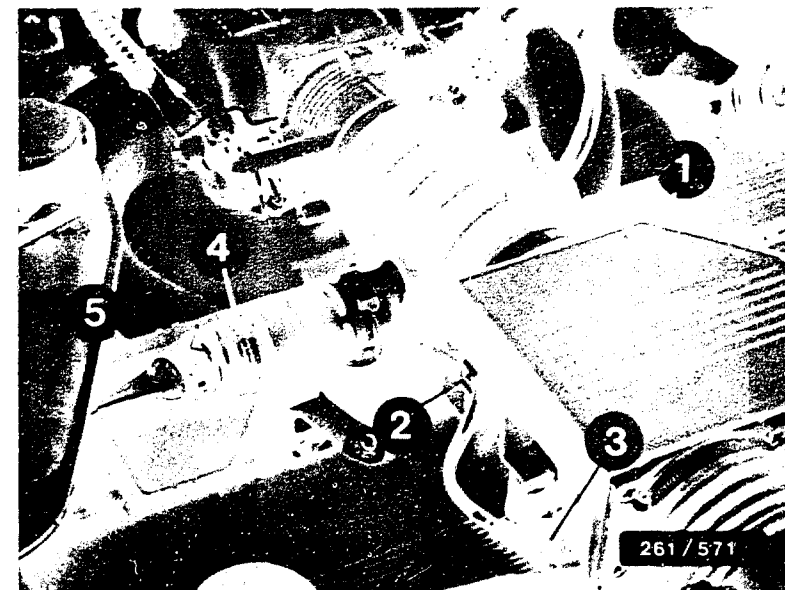
Carry out visual inspection  
on plug of idle adjuster:

Plug inserted correctly,  
contacts corroded? Spring  
contacts must be locked in  
place and it must be  
impossible to push them back.

Is plug O.K.?

Eliminate defects on plug.  
If necessary, replace plug  
or spring contacts.

Continued on next picture page



- 1 = Air-flow sensor
- 2 = CO adjusting screw
- 3 = Connector to  
air-flow sensor
- 4 = Idle actuator
- 5 = Connector

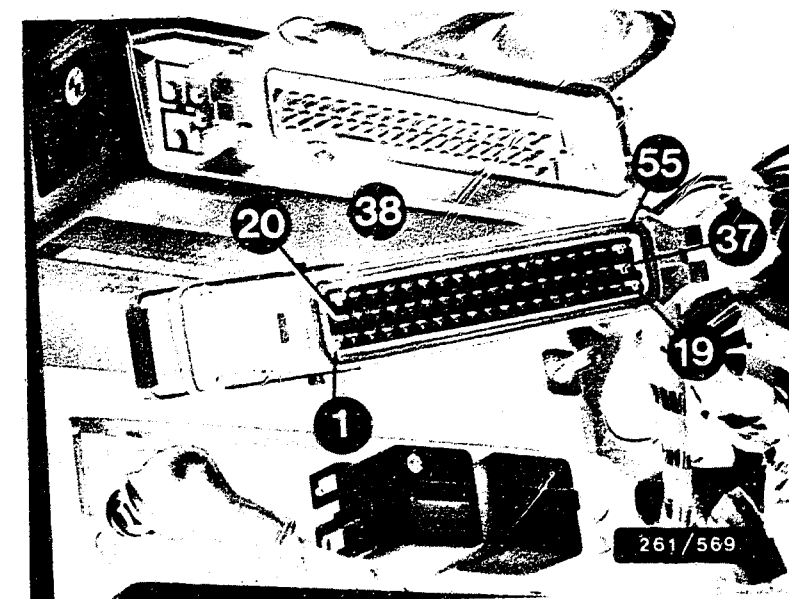
SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (13) CONTINUED ( 1)

Check leads from idle  
adjuster to control-unit  
plug term.4 and term.22  
with ohmmeter for open  
circuit and short circuit  
to ground, and for short  
circuit to positive.  
Watch for chafing  
points.

Leads O.K.?

N>

Eliminate contact resistances,  
open circuits or short circuits  
on leads.



Top view of 55-pin control-  
unit plug for Motronic  
wiring harness

Return to self-diagnosis  
test table B13

D01

<=>

D02

<=>

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (14)

SELF-DIAGNOSIS FLASHING CODE 1263

Check tank bleeder valve:

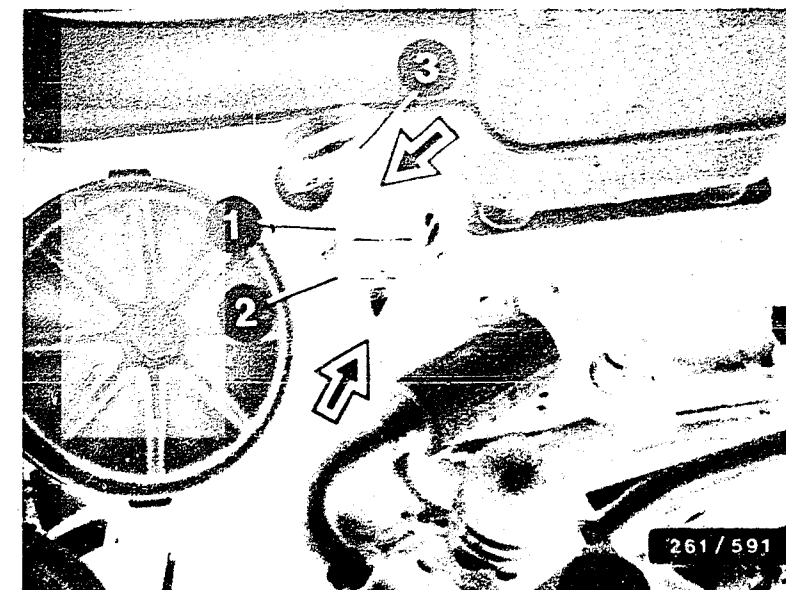
Detach plug from tank bleeder valve.

Check resistance value directly on pins of tank bleeder valve.

Set value:  
see brief instructions

Is set value obtained?

Replace tank bleeder valve.



- 1 = Tank bleeder valve
- 2 = Connector
- 3 = Connection to intake manifold

Carry out visual inspection on plug of tank bleeder valve:

Plug correctly inserted, contacts corroded? Spring contacts must be locked in place and it must be impossible to push them back.

Is plug O.K.?

Eliminate defects on plug. If necessary, replace plug or spring contacts.

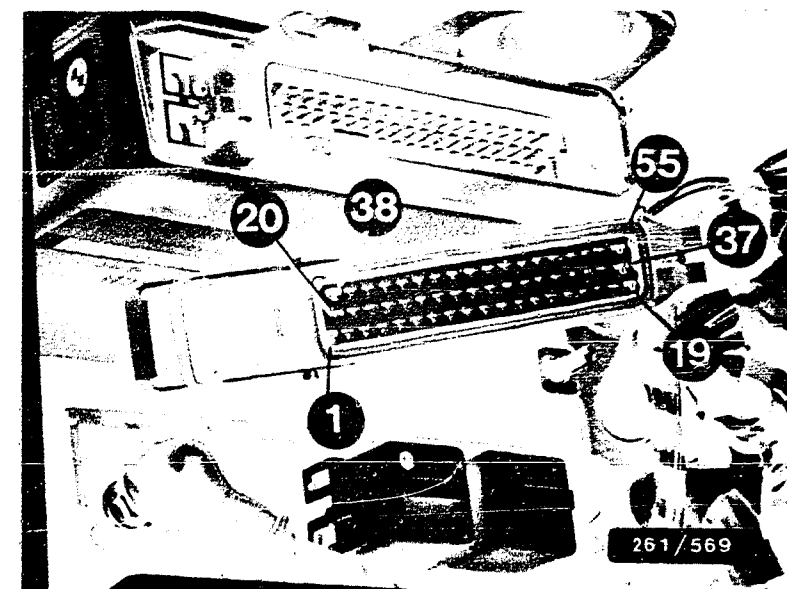
Continued on next picture page

SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (14) CONTINUED ( 1)

Check lead from tank  
bleeder valve to control-  
unit plug term.5 with  
ohmmeter for open circuit  
and short circuit to  
ground and for short  
circuit to positive.  
Watch for chafing  
points.

Leads O.K.?

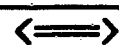
Eliminate contact resistances,  
open circuits or short circuits  
on leads.



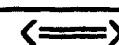
Top view of 55-pin control-  
unit plug for Motronic  
wiring harness

Return to self-diagnosis  
test table B13

D05



D06



# SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (15)

## SELF-DIAGNOSIS FLASHING CODE 1278\*

Transmission action constantly active via. term.51, i.e. term.51 stays const. at ground potential.

### Test:

With ignition switched on, measure voltage at connection 1 of 8-pin plug-in connection to transmission control unit.

Set value: higher 3.5 V

\* Applies to vehicles with electronic transmission control (GS)

Is voltage higher than 3.5 V ?

N>

## Operation of transmission action:

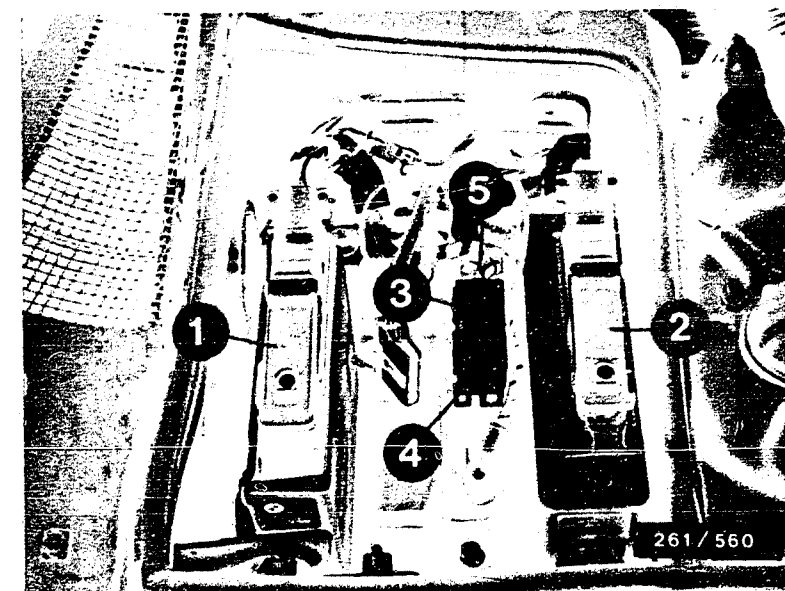
Motronic receives information regarding shifts from transmission control in the form of a pulse being issued to the Motronic control unit during the shift (bottom picture).

Possible fault causes with flashing code 1278:

- \*Lead from Motronic control unit via. 8-pin plug-in connection (term.1) to transmission control unit short-circuited to ground (chafing points ?)
- \*Transmission control unit defective (right-hand A pillar)
- \*Motronic control unit defective

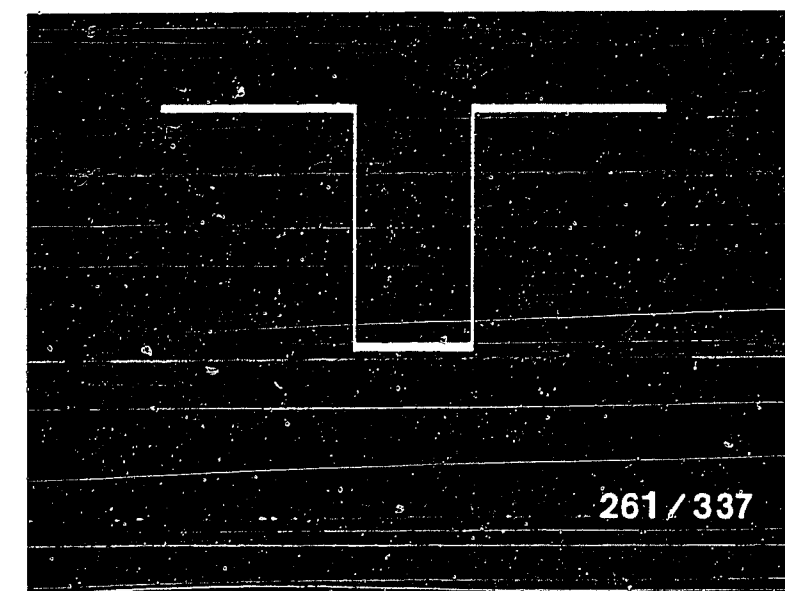
### Procedure:

- \*Switch off ignition. Detach 8-pin plug-in connection and once again measure voltage on Motronic side (ignition on).
- \*If result positive, check lead from adapter to transmission control unit, if necessary eliminate short circuit to ground, otherwise replace transmission control unit.
- \*If voltage is below 3.5 V, e.g. approx. 0 V, check lead to Motronic control unit, if necessary eliminate short circuit to ground, otherwise replace Motronic control unit.



- 1 = Motronic control unit
- 2 = ABS control unit
- 3 = Main relay
- 4 = Pump relay
- 5 = Plug-in connection with transmission control

## Engine-action signal



Return to self-diagnosis test table B13

# SELF-DIAGNOSIS TROUBLE-SHOOTING PROGRAM (16)

## SELF-DIAGNOSIS FLASHING CODE 1288

This flashing code tests a fault lamp which may be fitted in the vehicle ("Carb" lamp in U.S. models).

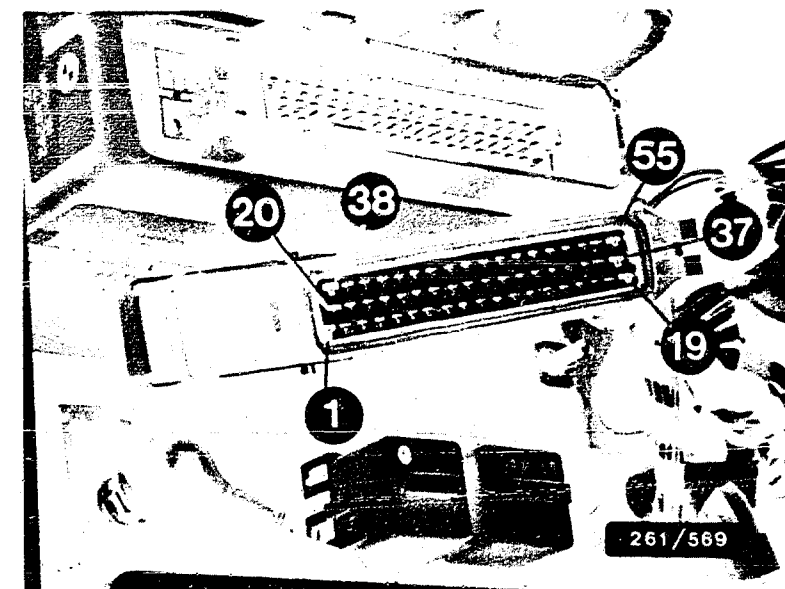
Test:

1. With self-diagnosis tester at the serial interface.
2. Check lead to control unit term.15 for chafing points and occasional contact with ground and other leads.

Leads O.K.?

Repair defective lead.

Return to self-diagnosis test table B13



Top view of 55-pin control-unit plug for Motronic wiring harness

# TROUBLE-SHOOTING PROGRAM ( 1 )

Check voltage supply of control unit.

Switch off ignition.

Disconnect control-unit plug.

Bridge term. 19 and term. 36 in plug.

Connect voltmeter to disconnected control-unit plug term. 37 (+) and term. 19 (-).

Switch on ignition.

SET VALUE: battery voltage

Is set value obtained?

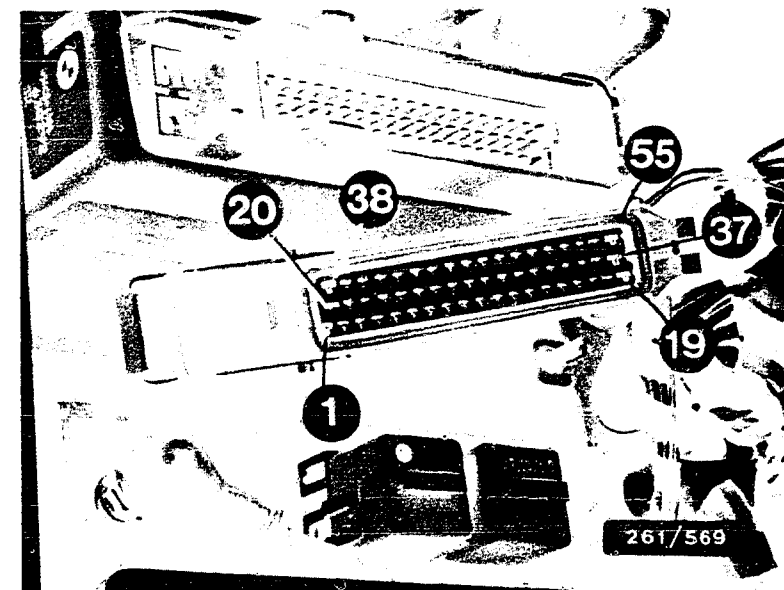
N>

Switch off ignition.

1. Connect ohmmeter to disconnected control-unit plug term. 19 and ground cable for control unit (lower illustration).

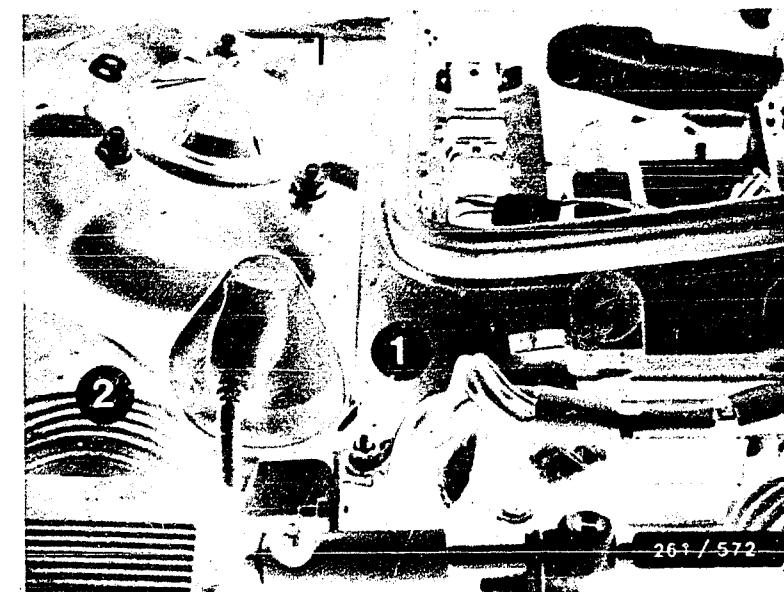
Ohmmeter must indicate 0  $\Omega$  (continuity).

Eliminate open circuit or contact resistance at ground terminal.



Top view of 55-pin control-unit plug for Motronic wiring harness

2 = Ignition coil

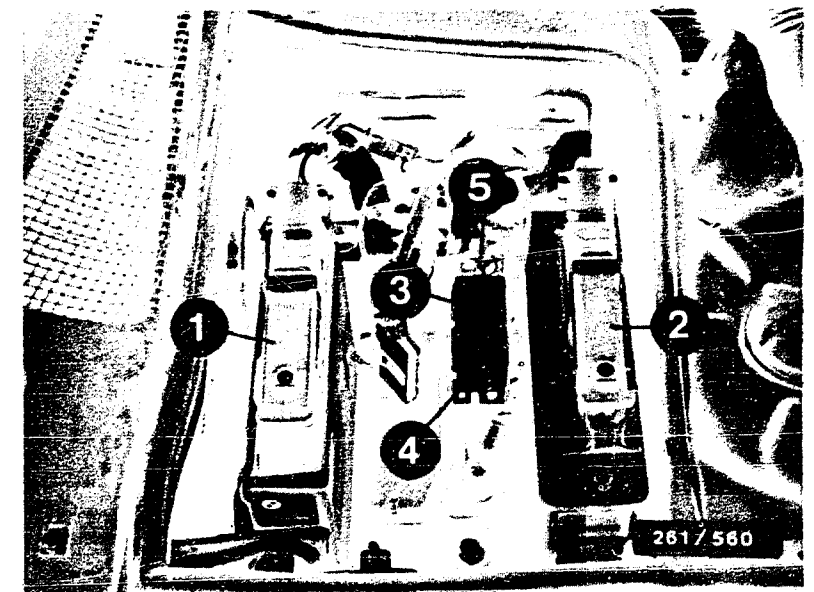


Return to trouble-shooting chart B03

Continued on next picture page

- ↓
2. Check following lead for continuity:  
from control unit term. 37  
to main relay term. 87.
  3. Measure voltages at main relay:  
(bridge term. 36 and  
term. 19 in control-unit  
plug).
  - 3.1 Disconnect relay and connect  
voltmeter to frame term. 86 (+)  
and term. 85 (-).  
Switch on ignition.  
Voltmeter must indicate  
battery voltage. If not,  
check lead from battery  
positive to relay term. 86  
and from relay term. 85  
to control unit term. 36  
for continuity.
  - 3.2 Connect voltmeter to  
relay frame term. 30 (+)  
and term. 85 (-).  
Battery voltage must be  
indicated. If not, check  
lead between term. 30  
and term. 86 in pin base.
  - 3.3 As of FD 652, connect voltmeter  
to control unit term. 27 (+)  
and ground.  
Switch on ignition.  
Battery voltage must be  
indicated. If not, check lead  
to driving switch term. 15.
- ↓

Continued on next picture page



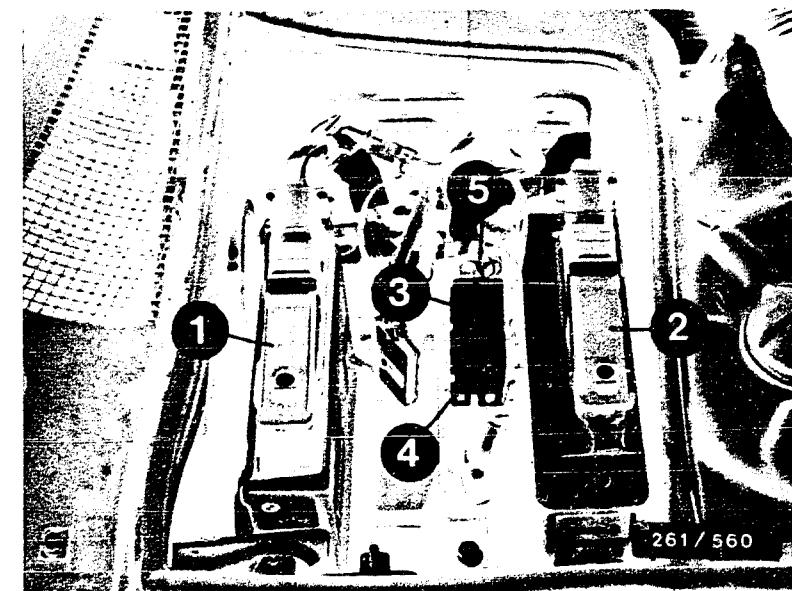
- 1 = Motronic control unit
- 2 = ABS control unit
- 3 = Main relay
- 4 = Pump relay
- 5 = Plug-in connection  
with transmission control



**4. Check main relay:**

With ignition switched on, main relay switches noticeably when connected and disconnected.

If switching is not noticeable, main relay defective.

**5. If all leads, plug-in connections and main relay O.K., control unit is defective.**

- 1 = Motronic control unit
- 2 = ABS control unit
- 3 = Main relay
- 4 = Pump relay
- 5 = Plug-in connection with transmission control

# TROUBLE-SHOOTING PROGRAM ( 2 )

Test internal resistance of engine-speed/ref.-mark sensor:

Detach plug-in connection to sensor.  
Connect ohmmeter at plug to sensor between term.1 and term.2.

Set value: see brief instructions

Is set value obtained?

N>

Sensor defective; replace.

Directions for replacement:

Unscrew fastening screw and pull out sensor.  
This may be easier by rotating sensor and/or using screwdriver.

Do not take new sensor from protective sleeve until shortly before installation.  
Before fitting the sensor, make sure that no metallic parts are attached to the sensor (sensors contain permanent magnets).

Grease sensor with Longterm 2 and press into hole by hand to the stop. Do not use force and do not hammer!

Pay attention to correct fitting of spring contacts in the plug. It must be impossible to push back spring contacts and they must be free of corrosion.  
Plug-in connection must latch in place.

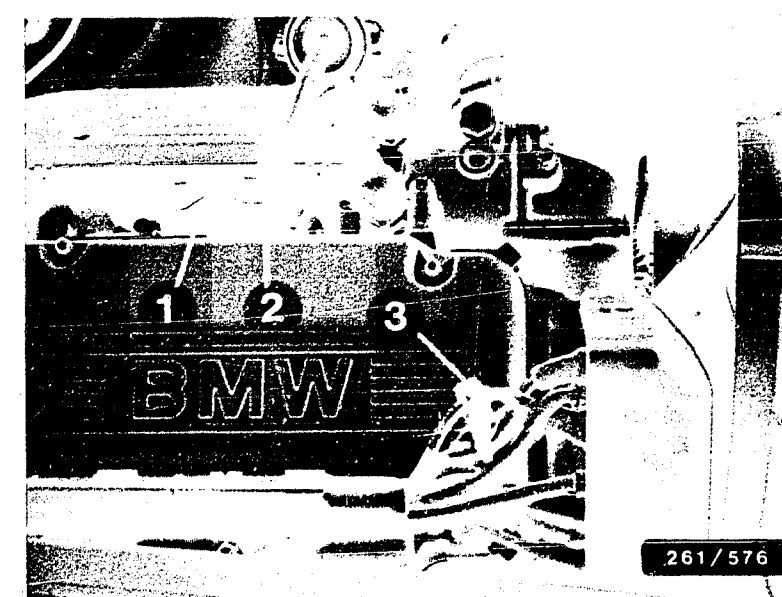
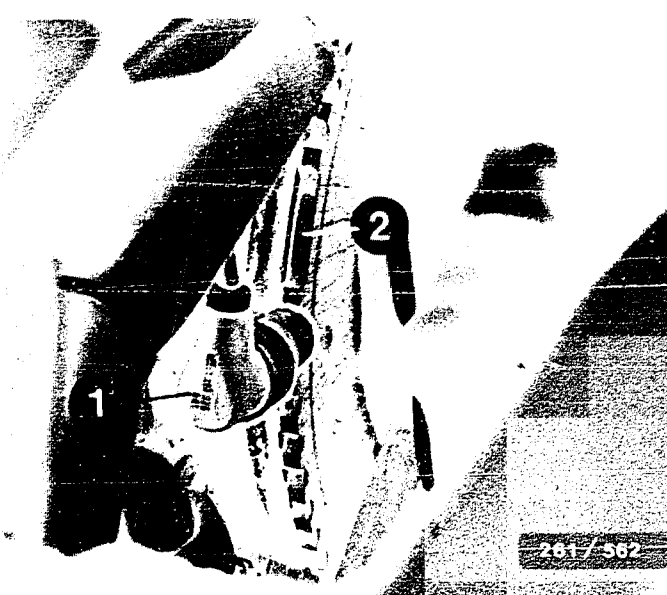
1 = Engine-speed/reference-mark sensor

2 = Ring gear with gap

1 = Plug-in connection of engine-speed/reference-mark sensor

2 = Plug-in connection of high-voltage sensor

3 = High-voltage sensor on H.T. lead to cylinder 6



Continued on next picture page

TROUBLE-SHOOTING PROGRAM ( 2 ) CONTINUED ( 1 )

Check engine-speed/reference-  
mark sensor for short circuit  
to ground (insulation damage):

Disconnect plug from control  
unit.  
Sensor plug connector  
connected.  
Connect ohmmeter to control-  
unit plug term. 47 and  
ground.

Set value: Infinity  $\Omega$

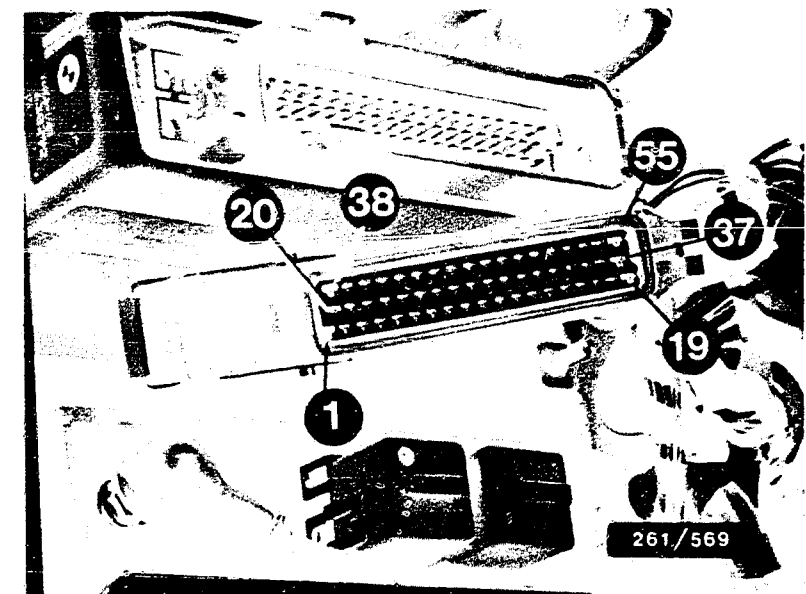
Watch for worn insulation and  
loose contacts.

Set value obtained?

N>

Set value less than 1 M  $\Omega$  :  
Repair defective lead from  
control unit term. 47 or  
term. 48 to sensor plug.

If sensor lead defective,  
replace sensor.



Top view of 55-pin control-  
unit plug for Motronic  
wiring harness

Continued on next picture page

V

Check the following leads for open circuit with ohmmeter:

From control-unit plug term. 47 to sensor plug connector term. 1 and from control-unit plug term. 48 to sensor plug connector term. 2.

Set values: 0  $\Omega$

Check plug for corrosion and loose contact.  
Contacts must not allow themselves to be pushed back.

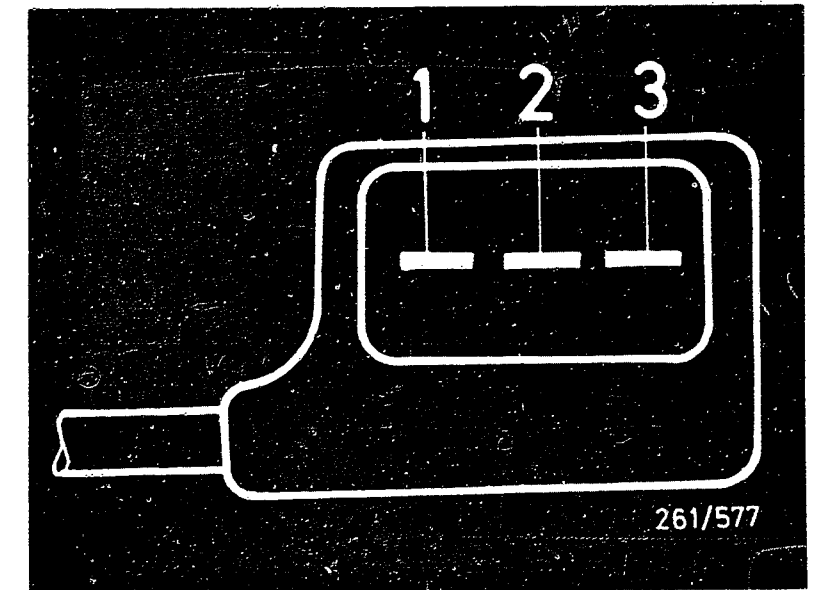
Set values obtained?  
Contacts O.K.?

Repair defective lead and/or plug.

N&gt;

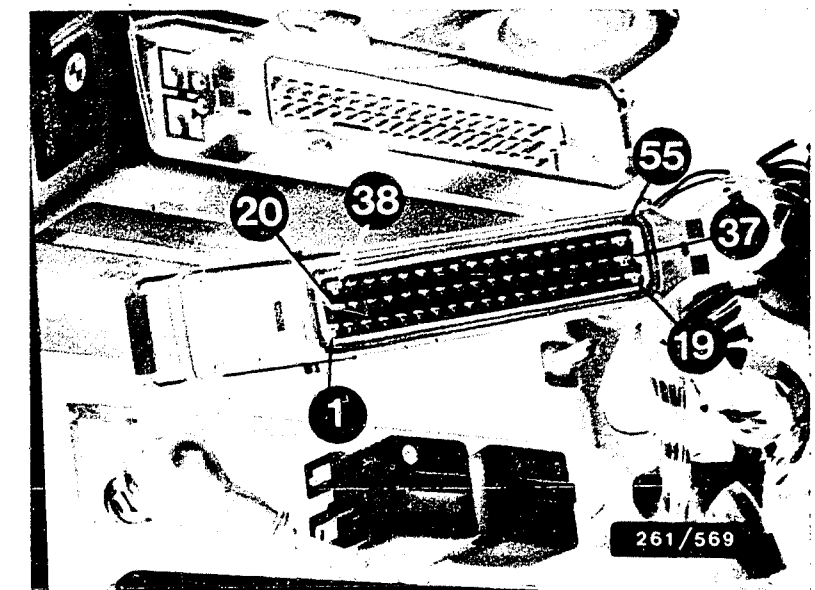
V

Continued on next picture page



Top view of engine-speed-sensor plug

Top view of 55-pin control-unit plug for Motronic wiring harness



# TROUBLE-SHOOTING PROGRAM ( 2 ) CONTINUED ( 3 )

Check signal from engine-speed/  
reference-mark sensor.

Take apart sensor plug  
connector.

Set motortester to special  
input.

Lever at left-hand stop  
(calibrated voltage range).

Connect special cable to plug  
of sensor:

Red tester clamp to term. 1(+)  
of sensor plug, black tester  
clamp to term. 2 (negative,  
center contact)..

Start engine.

Set value: See top picture.

Read off voltage.

**N o t e:**  
With the reference-mark  
signal, the negative amplitutde  
must appear first.

Signal O.K.?

N>

1. No signal or signal  
too small:

Measuring leads incorrectly  
connected.

Cranking speed less than  
200 min-1:  
Charge battery.

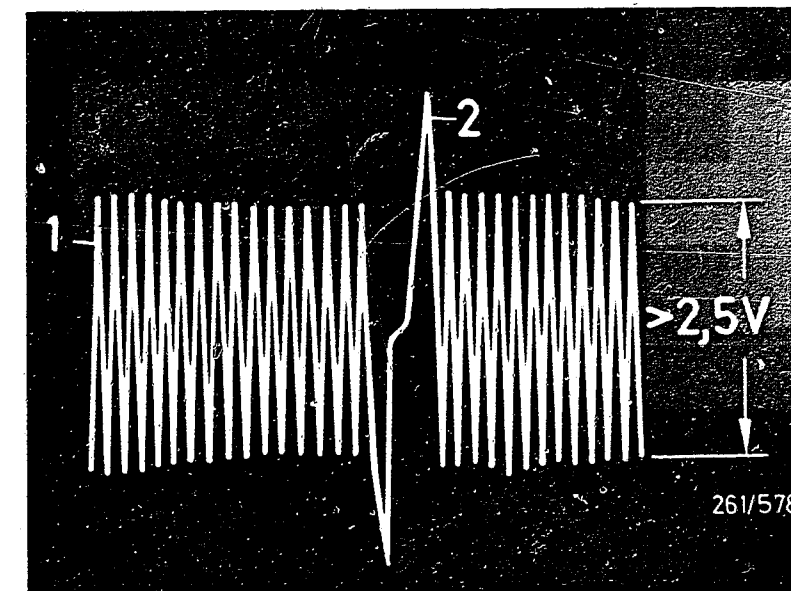
Sensor air gap too big.  
Nominal air gap:  
0,8 mm  $\pm$  0.3.

Sensor mechanically defective,  
replace.

2. Incorrect signal:

Ring gear defective.  
Note: Reference-mark signal  
is formed by several missing  
teeth in succession.

Positive amplitude appearing  
first: measuring leads  
incorrectly connected or sensor  
leads to control unit mixed  
up.  
Rectify in accordance with  
circuit diagram.



1 = Engine-speed signal  
2 = Reference-mark signal

Return to trouble-shooting chart  
B03

Continued on next picture page



Sensor defective; replace.

Directions for replacement:

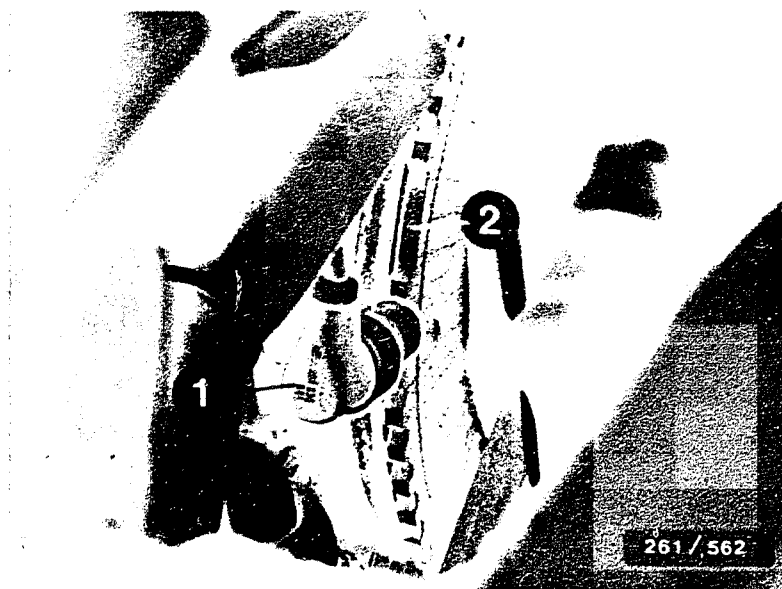
Unscrew fastening screw and pull out sensor.

This may be easier by rotating sensor and/or using screwdriver.

Do not take new sensor from protective sleeve until shortly before installation. Before fitting the sensor, make sure that no metallic parts are attached to the sensor (sensors contain permanent magnets).

Grease sensor with Longterm 2 and press into hole by hand to the stop. Do not use force and do not hammer!

Pay attention to correct fitting of spring contacts in the plug. It must be impossible to push back spring contacts and they must be free of corrosion. Plug-in connection must latch in place.



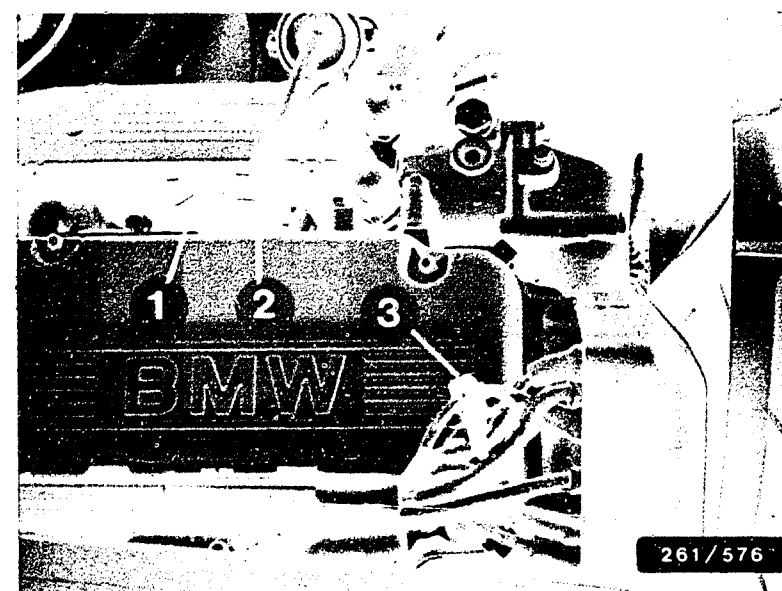
1 = Engine-speed/reference-mark sensor

2 = Ring gear with gap

1 = Plug-in connection of engine-speed/reference-mark sensor

2 = Plug-in connection of high-voltage sensor

3 = High-voltage sensor on H.T. lead to cylinder 6



# TROUBLE-SHOOTING PROGRAM ( 3 )

Check fuel pressure with engine stopped.

Measure pressure before pressure regulator. Measuring point at inlet of fuel-distribution pipe, at hose connection or at pressure damper (if applicable)

Loosen fuel-inlet hose.

**CAUTION!**

Catch escaping fuel; it must not get onto hot parts of the engine. Connect pressure tester KDJE-P100. Close valve screw. To connect, use three-way line KDJE-P100/13 (hose connection) or connecting part KDJE-P100/14 (screw connection M 14 x 1.5). Make sure there are no leaks. Connect jumper into connection base (for pump relay) between term. 87 and term. 30. The electric fuel pump must operate.

Fuel pressure

SET VALUE: see brief instructions

Set value obtained?

N>

\*Check pump fuse no.23.

\*Measure voltage at detached plug on fuel tank between term.4 and term.5 (bottom picture).

No voltage present:

Check leads from plug term.4 and term.5 to pump relay term.87 and pump ground lead.

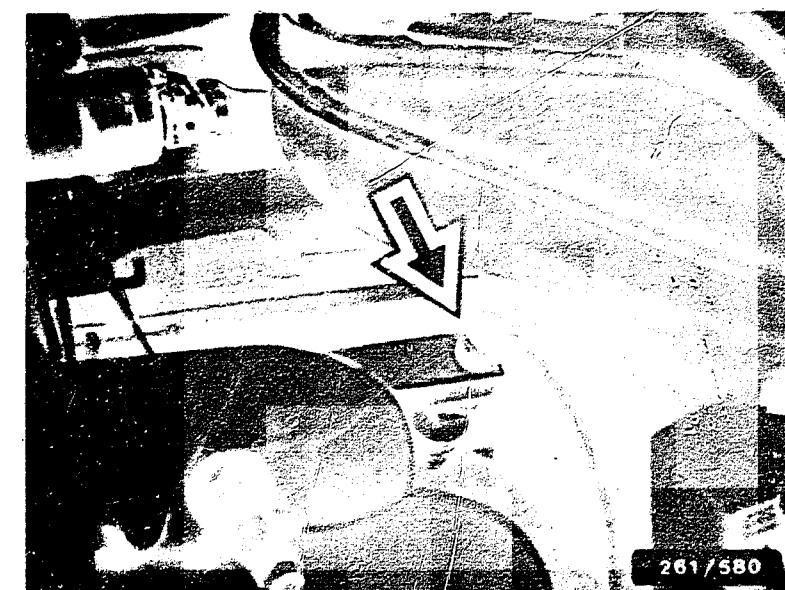
Run positive lead via engine plug term 13 (at fuse plug).

Voltage present:

Measure resistance of fuel pump between term.4 and term.5:

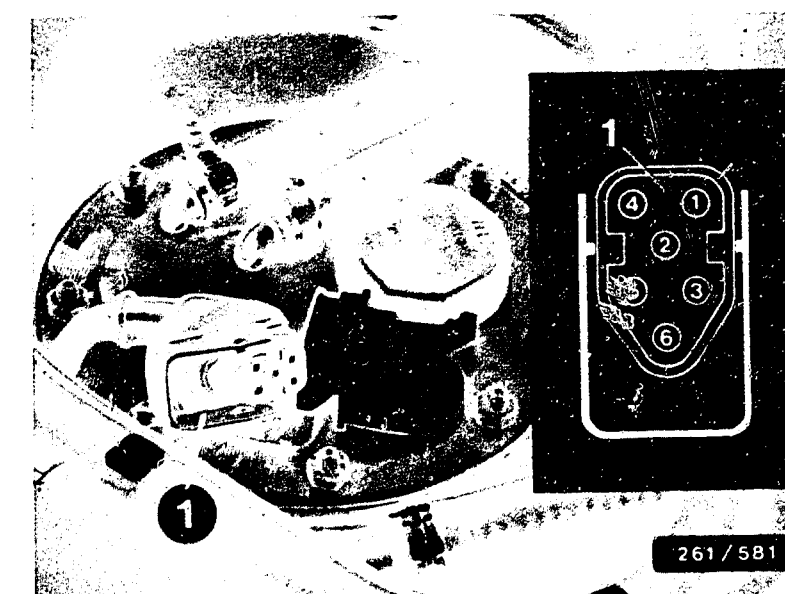
Set value: approx. 1  $\Omega$

Test pressure regulator and fuel pump hydraulically (see next micropicture).



Arrow = Connecting point for pressure gauge

Figure: Installation position of in-tank electric fuel pump  
1 = Connector on fuel tank (in luggage compartment)



Continued on next picture page

Continued on next picture page

V

Set value not reached:

\*Slowly pinch off fuel return line.

Caution: pressure must not rise above 6 bar.

If pressure rises above 5 bar  
→ replace pressure regulator.  
In case of O ring sealing, use new O rings. Lightly grease with silicone grease (Ft 2 v 1).  
Pressure does not rise sufficiently: fuel pump defective.

\*Fuel filter very dirty  
→ replace.

\*Fuel delivery line or pressure damper (if applicable) clogged  
→ replace.

\*Strainer in tank clogged.  
Corrosion in tank.

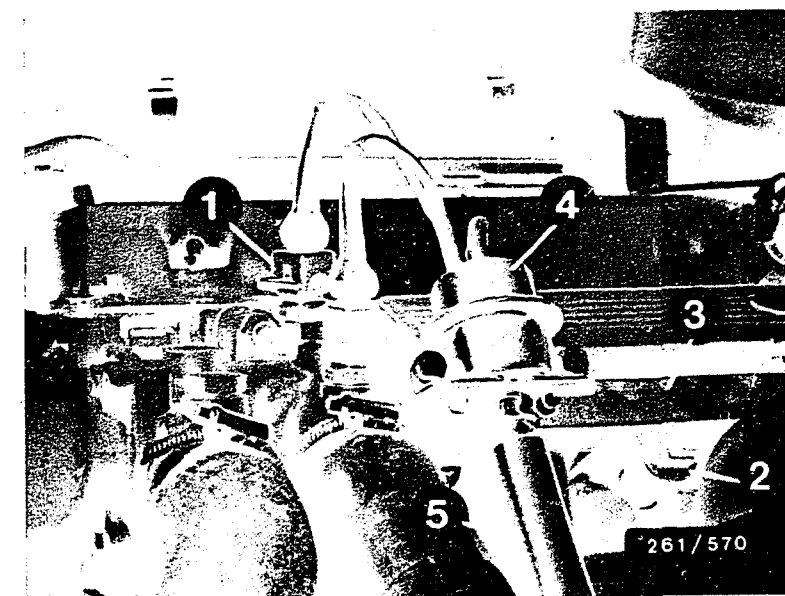
Set value exceeded:

Loosen fuel return hose from pressure regulator. Mount test hose on pressure regulator and lead into a 1.5l measuring glass.

Is set value now obtained?

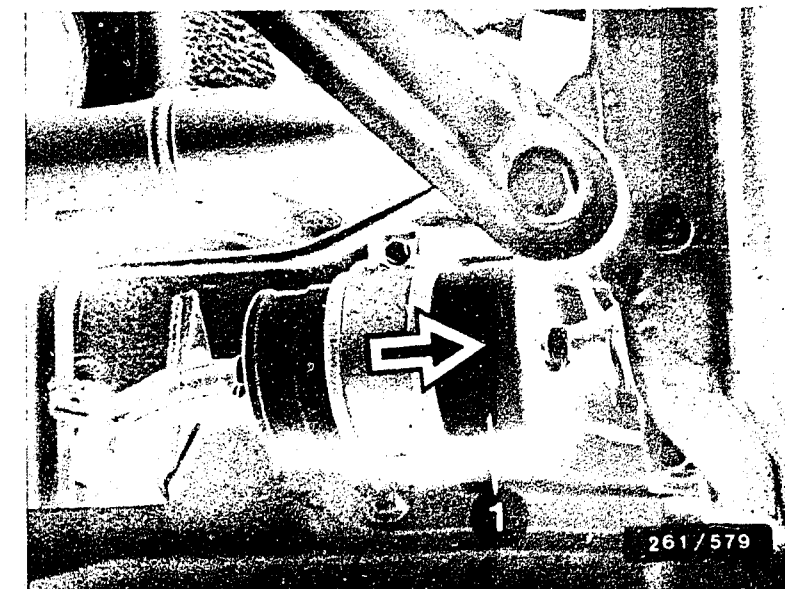
\*If yes, fuel return line clogged or pinched → replace.

\*If not, pressure regulator defective → replace.



- 1 = Coolant-temperature sensor
- 2 = Injection valve
- 3 = Fuel-distribution pipe
- 4 = Pressure regulator
- 5 = Return

- 1 = Fuel filter
- Arrow = Direction of flow



Continued on next picture page



# TROUBLE-SHOOTING PROGRAM ( 3 ) CONTINUED ( 2 )

Check fuel delivery.

Measure fuel delivery of electric fuel pump against pressure. Therefore, measuring point at return, after pressure regulator.

Disconnect fuel-return hose from pressure regulator. Mount test hose on pressure regulator and lead into a 1.5 l measuring glass.

Disconnect pump relay. Connect jumper into connection base between term. 87 and term. 30. The electric fuel pump must operate. Measuring time 30 sec.

Fuel delivery  
SET VALUE: See brief instructions

Set value obtained?

After testing is finished:

Remove jumper and connect pump relay in connection base.

Remove test hose and mount fuel return hose on pressure regulator. Make sure there are no leaks.

Return to trouble-shooting chart B03

\*Fuel filter heavily soiled, replace.

\*Fuel pressure line or pressure damper (if fitted) blocked, replace.

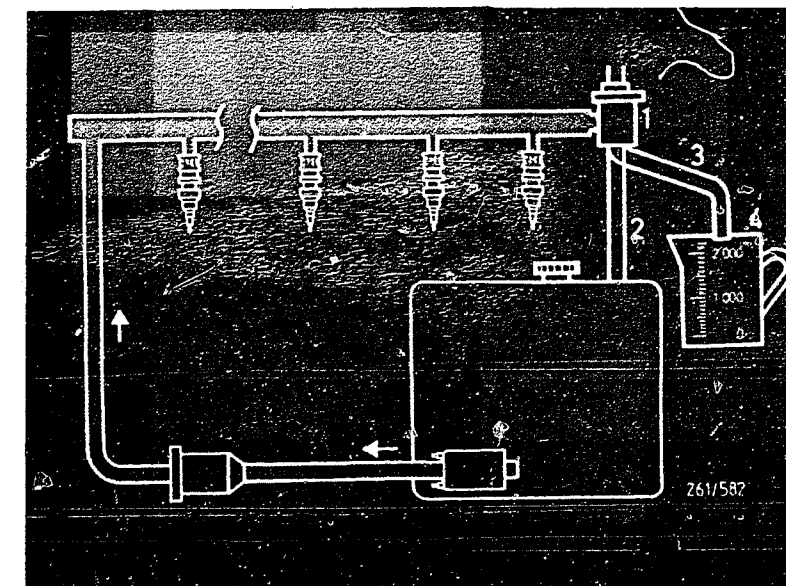
\*Voltage at electric fuel pump with engine running, min. 12 V. If not, clean contacts, remedy poor ground connection, replace leads.

\*Check pre-supply pump (if fitted). Measuring point: Line between the pumps. Delivery quantity must be at least 10% greater than that of electric fuel pump. If not, replace pre-supply pump.

\*If fuel-pump output is too low, replace electric fuel pump, clean connecting points before separation to prevent dirt from entering fuel system. In-tank electric fuel pumps are accessible via a plug on the tank.

\*If electric fuel pump is noisy (vapor bubbles), suction line restricted or kinked, replace. Strainer in tank blocked, replace. Corrosion in tank, clean or replace.

\*Pressure reg. defective, check.



Pressureless

Fuel pressure

1 = Pressure regulator

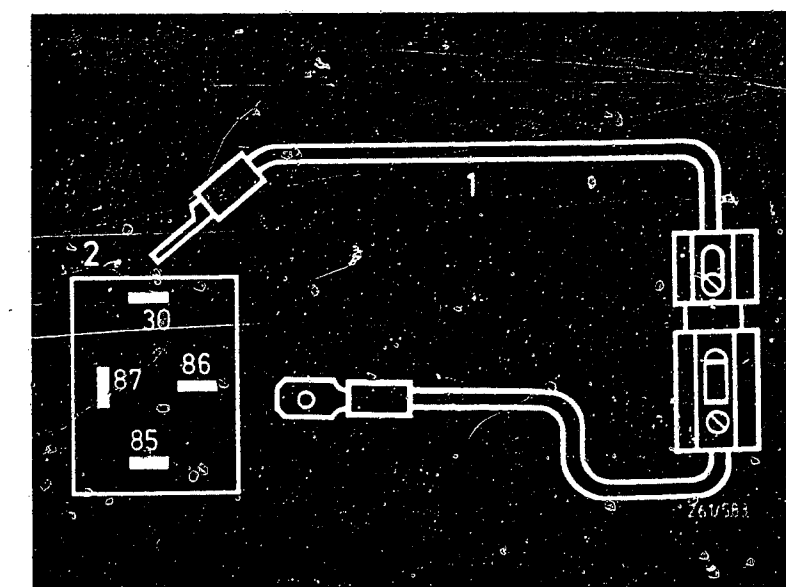
2 = Return

3 = Test hose

4 = Measuring glass

1 = Jumper with fuse holder and 10 A fuse (user-fabricated)

2 = Top view of connection base



# TROUBLE-SHOOTING PROGRAM ( 4 )

Test solenoid-operated injection valves with engine running.

With engine running, detach each injection-valve plug individually one after the other from the solenoid-operated injection valves and plug in again.

If the solenoid-operated injection valve is O.K. engine speed must briefly drop.

Set value: drop in engine speed

Is set value obtained?

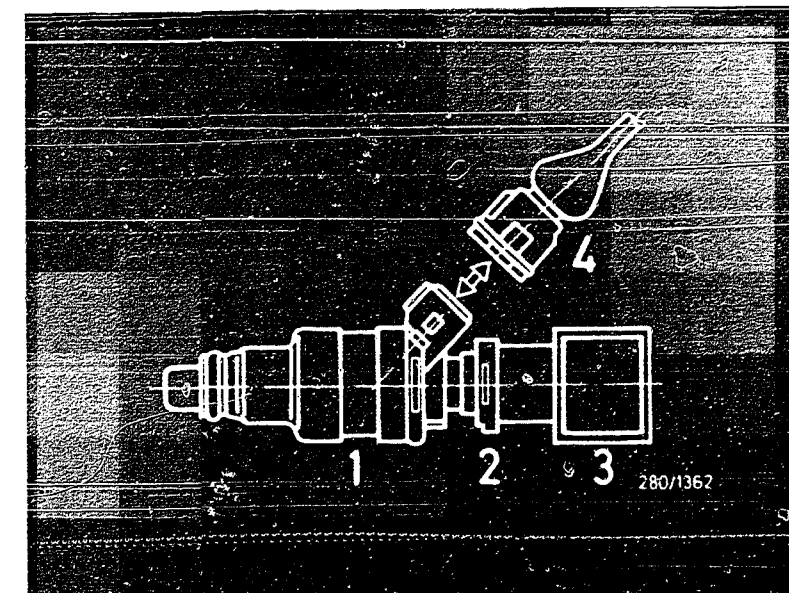
N>

No engine-speed drop ->

\*Check solenoid-operated injection valve using ohmmeter. Set val.: see brief instructions. If necessary, replace defective injection valve.

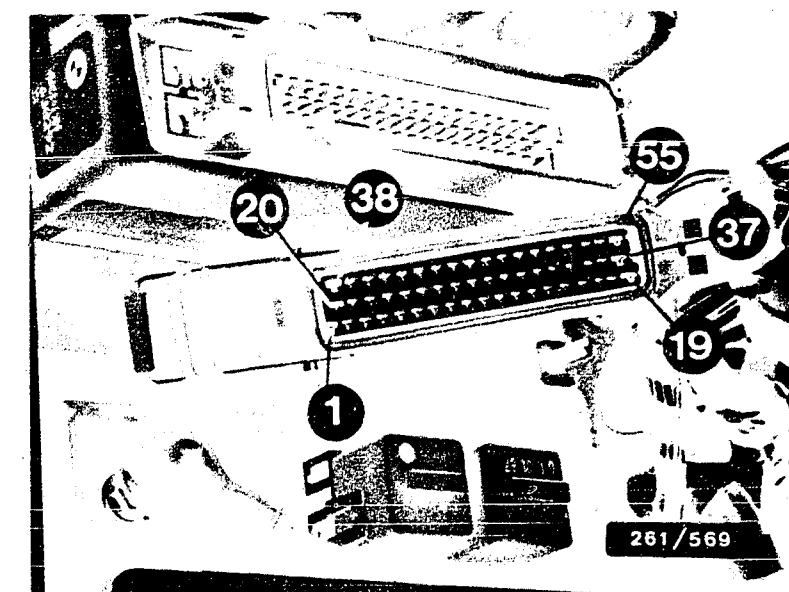
\*Check positive leads from injection valves to main relay term.87 for continuity and negative leads to control unit term.16 (cylinders 1+3+5) and term.17 (cylinders 2+4+6).

\*Replace appropriate solenoid-operated injection valve (mechanical defect).



- 1 = Injection valve
- 2 = Holding clamp
- 3 = Fuel-distribution pipe
- 4 = Connector

Top view of 55-pin control-unit plug for Motronic wiring harness



Continued on next picture page

Measure signal at solenoid-operated injection valve.  
Check function and interference.

Raise cover over injection valves (bottom picture).

Set motortester to special input.  
Connect black clip to vehicle ground.  
Connect red clip with suitable test prod initially to one pin of an injection-valve plug.

Start engine or leave it running.

Note:

As the terminal assignment of the injection-valve plugs is not standard, the negative lead of the injection valve must be determined.

If no injection pulses can be seen, connect red clip to other pin of injection-valve plug.

Start engine again if necessary.

Set value: top picture

Is set value attained?

N>

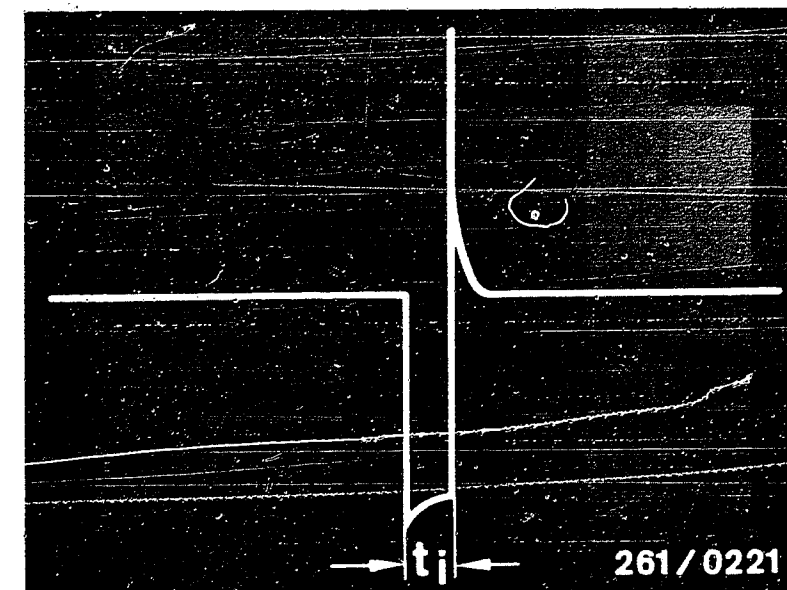
\*No injection signal visible:  
Check positive leads from injection valves to main relay term.87 for continuity. Do the same with negative leads to control unit term.16 and term.17. If leads are O.K., control unit defective.

\*In the event of interference, check cable installation, i.e. check spacing of H.T. ignition cables from wiring harness. Also check generator (e.g. worn carbon brushes) and generator regulator.

\*In the event of misfiring, check all injection-valve plugs and all other connections:

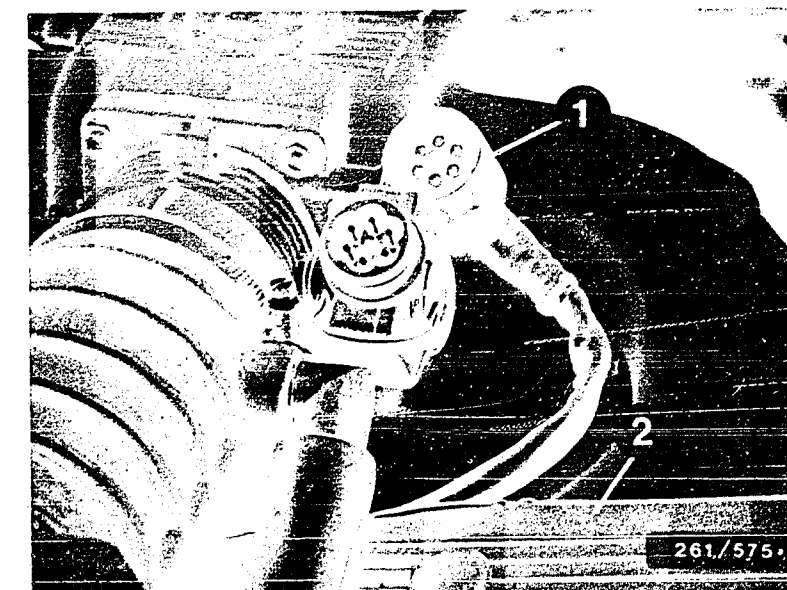
Spring contacts in plug must be locked in place and it must be impossible to push them back. Contact surfaces must be bare.

Move connections with engine running and watch for misfiring.



Injection signal  
 $t_i$  = Duration of injection

2 = Cover over injection valves



Continued on next picture page

# TROUBLE-SHOOTING PROGRAM ( 4 ) CONTINUED ( 2 )

Check fuel pressure with engine running.

Let engine idle.

Fuel pressure  
SET VALUE: approx. 0.5 bar  
lower than with engine stopped.

Set value obtained?

N>

Check fuel pressure after switching off engine (checking for leaks).

Fuel pressure  
SET VALUE: min. 1.0 bar  
after 20 minutes.

Set value obtained?

N>

After testing is finished:

Remove jumper and connect pump relay in connection base.

Remove pressure tester.  
Connect fuel-inlet hose to fuel-distribution pipe.  
Make sure there are no leaks.

Return to trouble-shooting chart B03

\*Intake-manifold-pressure energization of pressure regulator not O.K. Hose line between pressure regulator and intake manifold clogged or leaking → replace.  
Hose line dropped off → re-connect.

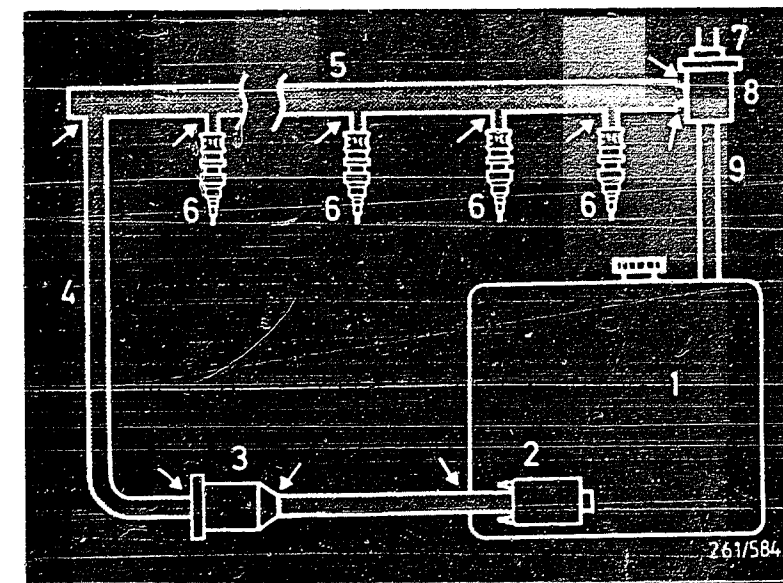
\*If intake-manifold-pressure energization O.K. → replace pressure regulator.

\*Leaking at joints between components, fuel hoses and fuel lines → tighten hose binder or replace hose.

\*Pressure regulator (diaphragm) leaking → replace.

\*Electric fuel pump (non-return valve) leaking.  
With screw-type non-return valve → replace.  
With integral non-return valve → replace electric fuel pump.

\*Pressure damper or fuel filter leaking → replace.



- 1 = Fuel tank
- 2 = Electric fuel pump (in tank)
- 3 = Fuel filter
- 4 = Inlet, fuel-injection tubing
- 5 = Fuel-distribution pipe
- 6 = Injection valves
- 7 = Intake-manifold pressure connect
- 8 = Pressure regulator
- 9 = Return line

Arrow = Possible leaking junctions

Continued on next picture page

\*Leak in injection valve(s)  
at point of connection with  
fuel distributor; renew  
O-ring. See text below.

\*Check injection valve(s)  
(needle seat) for leaks:

Remove complete fuel distributor.  
Supply and return remain  
connected. Simultaneously  
pull all injection valves  
out of intake-manifold guide.

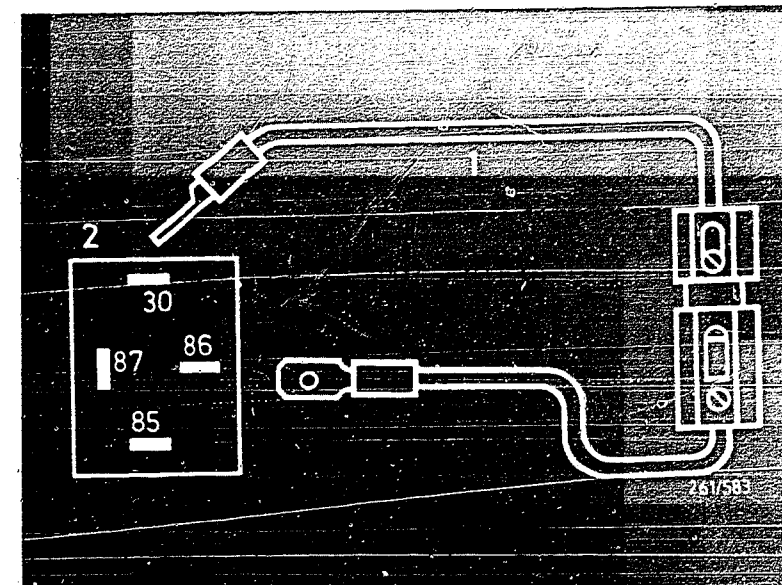
Fit jumper between term. 87  
and term. 30 in connection  
frame (pump relay).  
Electric fuel pump must  
run.

Set value:

No droplets may drip off the  
injection valve within 60 s.  
If they do so, renew injection  
valve.

Removal:

Detach connector.  
Pull out retaining clip.  
Remove injection valve.  
Caution!  
Catch any fuel which emerges.  
It must not be allowed to make  
contact with hot engine components.



1 = Jumper with fuse holder  
and 10 A fuse (user-  
fabricated)

2 = Top view of connection  
base

1 = Fuel-distribution pipe

2 = Holding clamp

3 = Upper O-ring

4 = Part number

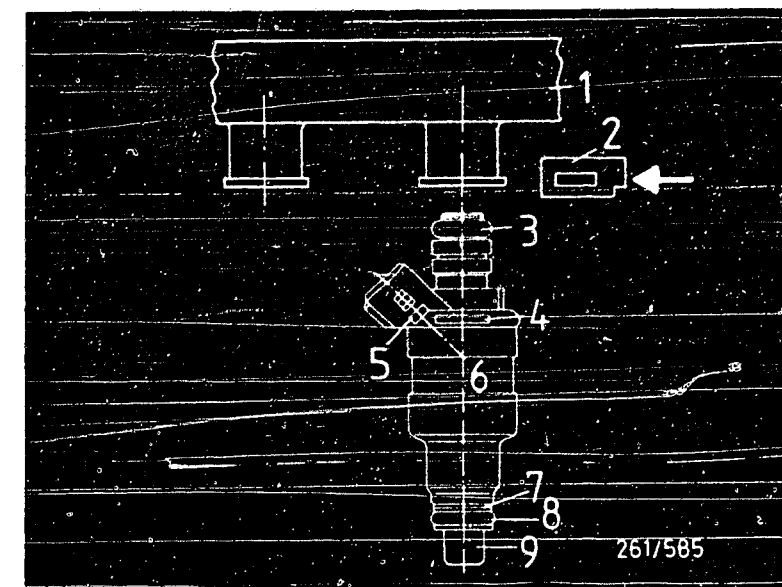
5 = FD mark

6 = Injection valve

7 = Supporting plate

8 = Lower O-ring

9 = Protective sleeve



Continued on next picture page

V

If injection valve (needle seat) is leakproof but O-ring is defective, then renew O-ring.

Use new parts set.  
Caution! Do not damage protection sleeve and valve needle.

Renew upper O-ring (fuel distributor) if it is damaged.

Cut up lower O-ring (intake manifold) if it is defective.  
Fit new O-ring over protection sleeve and its beading.

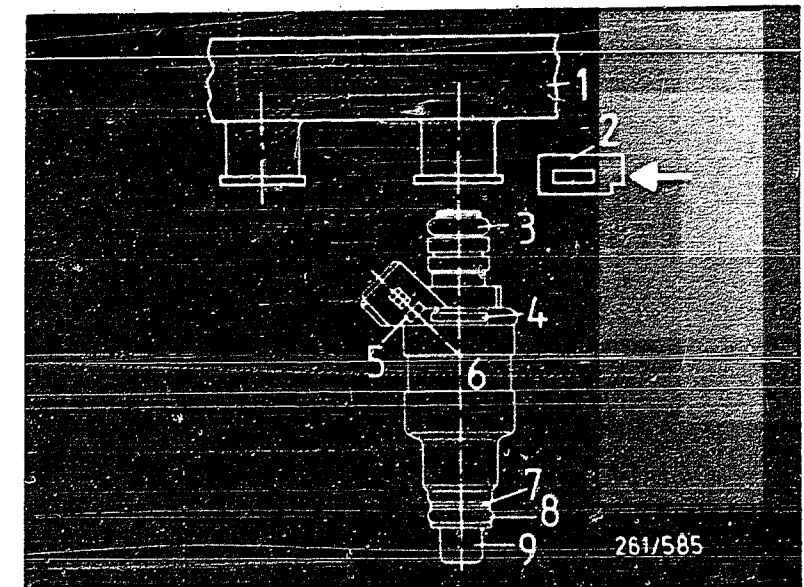
#### Installation:

Only grease O-rings slightly (silicone grease Ft 2 v 1).  
Attach injection valve to fuel distributor.  
Slip retaining clip into groove and allow it to engage.  
Check for fuel leaks.  
Fit connector.

Install complete fuel distributor.  
In doing so, press all injection valves evenly into intake-manifold guide.

#### Caution!

Do not damage O-rings and/or valve needles.  
Make sure there are no intake-manifold leaks.



- 1 = Fuel-distribution pipe
- 2 = Holding clamp
- 3 = Upper O-ring
- 4 = Part number
- 5 = FD mark
- 6 = Injection valve
- 7 = Supporting plate
- 8 = Lower O-ring
- 9 = Protective sleeve

# TROUBLE-SHOOTING PROGRAM ( 5 )

Mechanically check air-flow sensor:

Remove air-flow sensor.

Open sensor flap by hand.

It must be possible to open sensor flap smoothly with ease to the stop and it must reclose to the stop automatically.

Sensor flap must not catch during opening.

Watch for traces of rubbing.

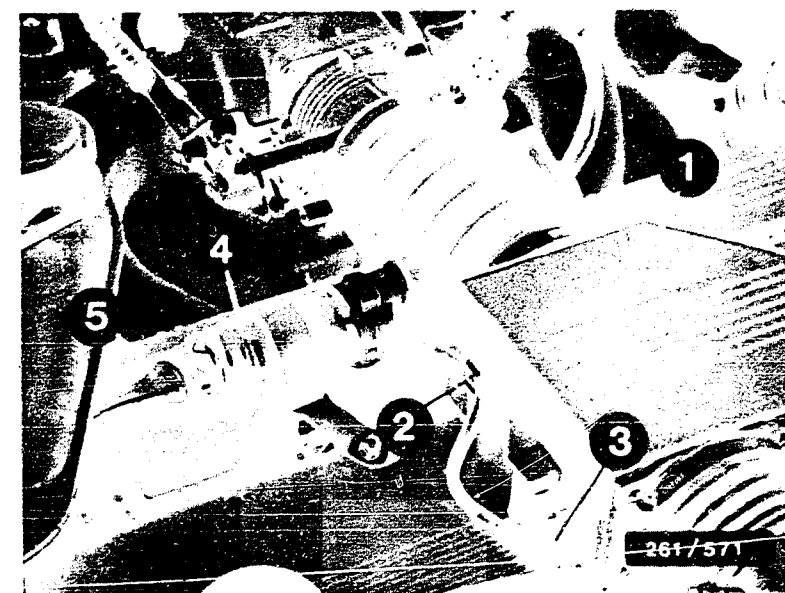
Clean air-flow sensor if heavily soiled inside and wipe with lint-free cloth.

Can sensor flap be opened easily and smoothly?

No traces of rubbing visible?

N>

Replace air-flow sensor.



- 1 = Air-flow sensor
- 2 = CO adjusting screw
- 3 = Connector to air-flow sensor
- 4 = Idle actuator
- 5 = Connector

Continued on next picture page



# TROUBLE-SHOOTING PROGRAM ( 5) CONTINUED ( 1)

Electrical test of air-flow sensor:

Remove air-flow sensor.

Leave plug on. Push back rubber sleeve on plug.  
Connect voltmeter to plug term. 2(+) and term. 4(-) with test prods.  
Switch on ignition.  
Measure voltage.

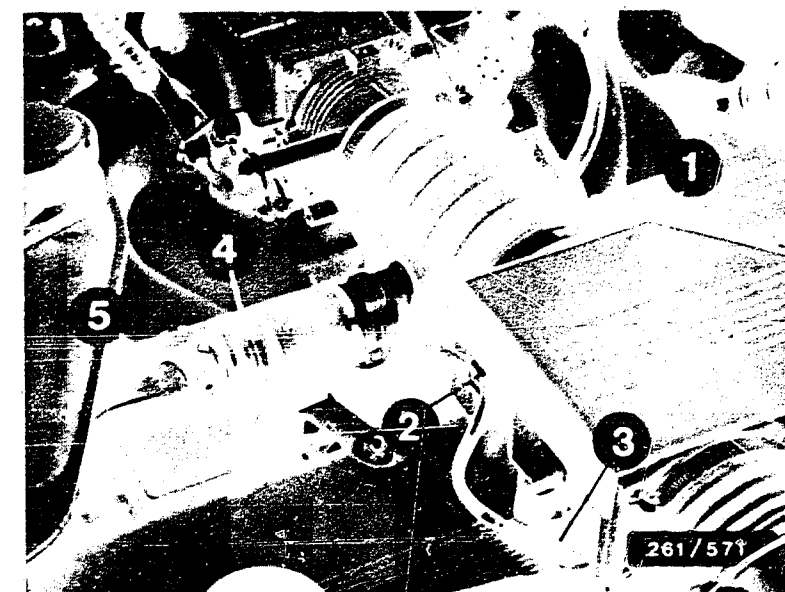
SET VALUES:

Sensor flap in rest position:  
200...300 mV

Open sensor flap by hand as far as it will go:  
greater than 4,2 V

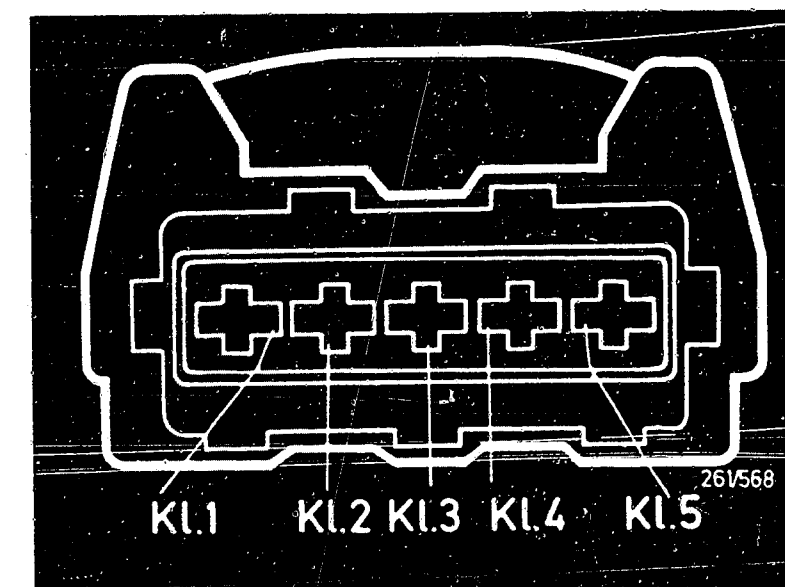
Set values obtained?

Replace air-flow sensor.



- 1 = Air-flow sensor
- 2 = CO adjusting screw
- 3 = Connector to air-flow sensor
- 4 = Idle actuator
- 5 = Connector

Top view of plug for air-flow sensor



Continued on next picture page



Using oscilloscope, check potentiometer in air-flow sensor (noise test).

\* Remove air-flow sensor. Leave electrical connector connected. Push back rubber grommet.

Set motortester to special input.

Connect red clip to term. 2, black clip to term. 4 of air-flow sensor.

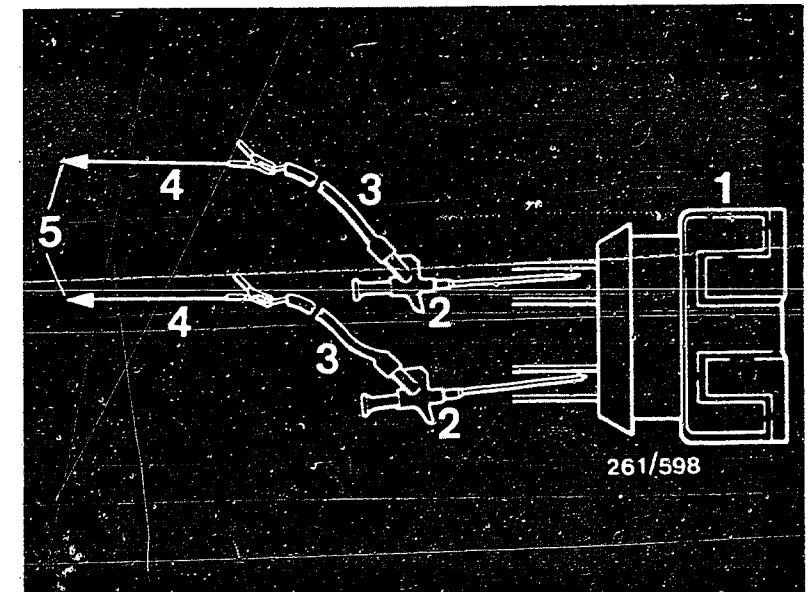
\* Fabricate adapter lead: two approx. 1 m long leads, approx. 1.0 mm <sup>2</sup> cross-section.

Secure 2 test prods to the one end. On the other end, remove approx. 2 cm of plastic insulation and clamp to the terminals of the special-input connecting lead.

**A T T E N T I O N !**

Insulate bare junctions of the adapter lead. (Danger of short circuit). Carefully insert into the connector of the air-flow sensor.

Do not bend spring contacts! Set control lever for picture adjustment on motortester to left-hand stop (calibrated adjustment).



- 1 = Air-flow-sensor connector
- 2 = Clamp-on test prod
- 3 = Adapter lead (user-fabricated)
- 4 = Special-input connecting lead
- 5 = Motortester special input

Continued on next picture page

TROUBLE-SHOOTING PROGRAM ( 5) CONTINUED ( 3)

\* Switch on ignition.

\* Violently deflect air-flow-sensor flap several times.

If air-flow sensor is in good working order, a stroke signal without dips must be visible on the oscilloscope.

If the air-flow sensor is defective, a noise signal similar to that in the figure opposite appears.

Replace air-flow sensor.

Disconnect adapter lead after the test and connect rubber grommet properly.

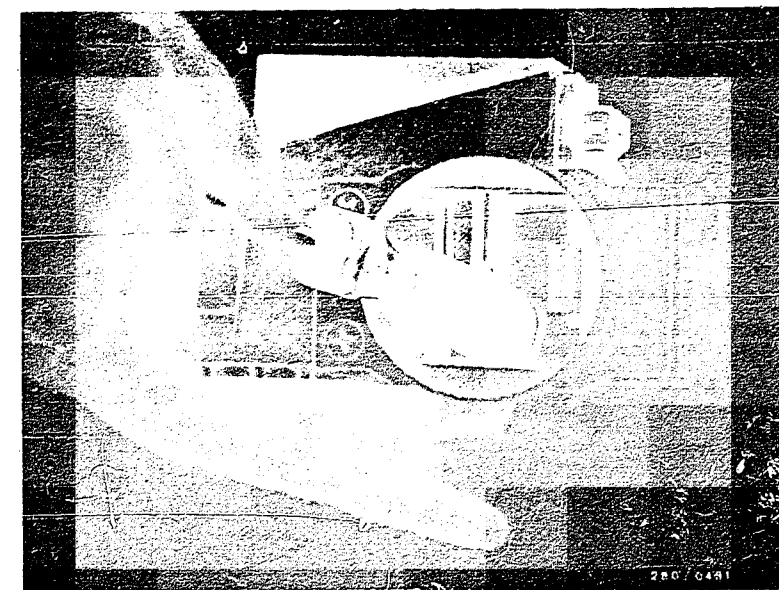
Fit air-flow sensor.

Connect all hoses and tighten (make sure of no leaks).

Signal O.K.?

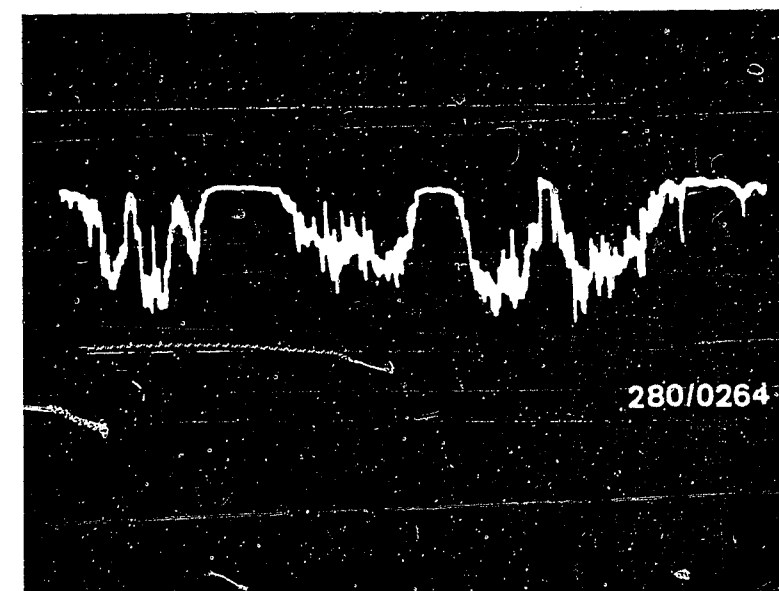
N>

Exchange air-flow sensor.



Push on air-flow-sensor flap.

Noise signal if air-flow sensor defective



Continued on next picture page

Check idle contact:

Detach plug at throttle-valve switch.

Throttle valve closed.

Connect ohmmeter to throttle-valve switch term. 2 (6)\* and 18 (4)\*.

Set value: Approx. 0  $\Omega$  (continuity)

Open throttle valve somewhat:

Reading must change to infinity  $\Omega$ .

Slowly close throttle valve

again: Reading changes to approx. 0  $\Omega$ .

Does resistance value change from approx. 0  $\Omega$  to infinity  $\Omega$  and vice versa?

\*) Number in brackets applies to motor vehicles with electronic transmission control

N>

\*Idle contact does not close (reading stays constantly at infinite  $\Omega$ ) or idle contact opens too late:

Adjust throttle-valve switch.

\*Conditions for adjustment of throttle-valve switch:

+Throttle valve correctly adjusted? It must come up against the stop screw shortly before wedging with the lever. Lock screw to prevent maladjustment.

+Adjust accelerator cable or linkage so that it is free of tension. If bent, replace.

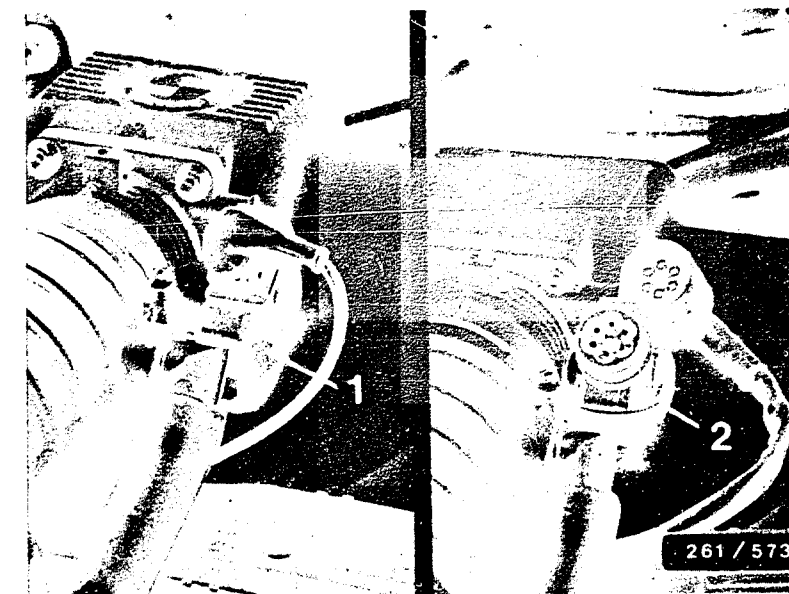
Adjusting the throttle-valve switch:

Slacken fastening screws slightly. Connect ohmmeter at throttle-valve switch between term. 2(6)\* and term. 18(4)\*. Turn throttle-valve switch until idle contact closes. (Microswitch clicks audibly).

Reading 0  $\Omega$ . If not, replace throttle-valve switch.

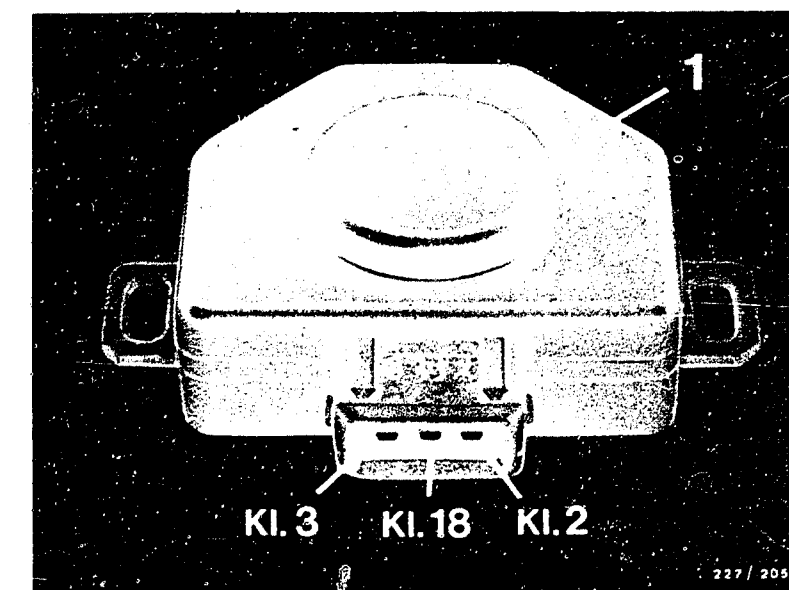
Adjustment check:

Tighten accelerator cable slightly. Idle contact must open (microswitch clicks audibly. Reading: infinite  $\Omega$ ).



- 1 = Throttle-valve switch with manually shifted transmission
- 2 = Throttle-valve switch (with pot) with electronic transmission control

- 1 = Throttle-valve switch in the case of manual transmission



Continued on next picture page

Use ohmmeter to check following leads for open-circuit:

N&gt;

Repair defective lead/plug.

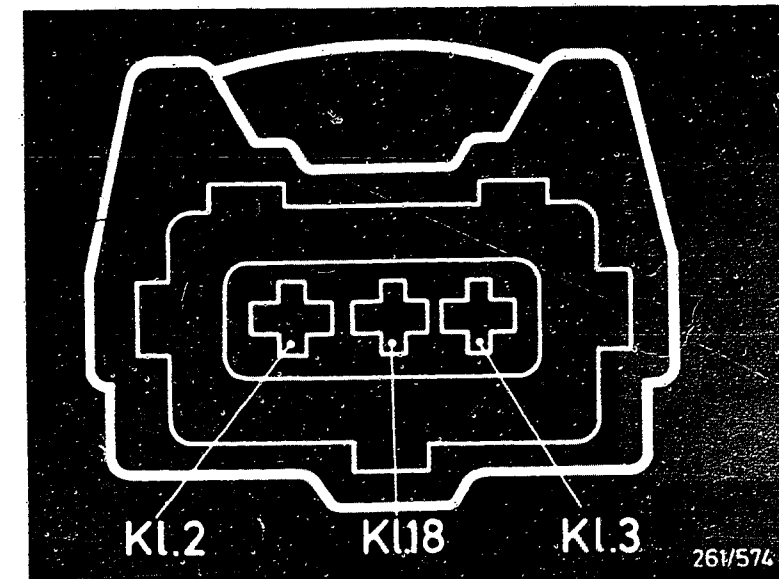
From control unit, term. 52 to throttle-valve switch, term. 2(6)\* and from throttle-valve switch, term. 18(4)\* to ground.

Set values: Approx. 0  $\Omega$

Check plug for corrosion and loose contact.  
It must not be possible to push back contacts.

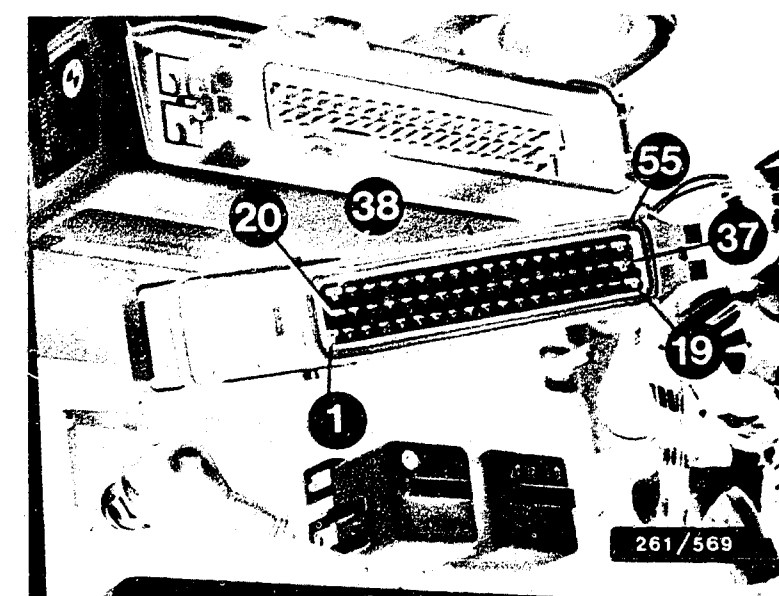
Are set values attained?  
Contacts O.K.?

\* Values in brackets apply to motor vehicles with electronic transmission control.



Throttle-valve-switch plug

Top view of 55-pin control-unit plug for Motronic wiring harness



Return to trouble-shooting chart B03

# TROUBLE-SHOOTING PROGRAM ( 6 )

Check full-load contact:

Detach plug from throttle-valve switch.  
Connect ohmmeter to throttle-valve switch

term. 3(5)\*  
and term. 18(4)\*

Open throttle valve as far as it will go:

Set value:  
The reading switches from infinity  $\Omega$  to approx. 0  $\Omega$  before full-load stop.

Does reading change from infinity  $\Omega$  to approx. 0  $\Omega$  ?

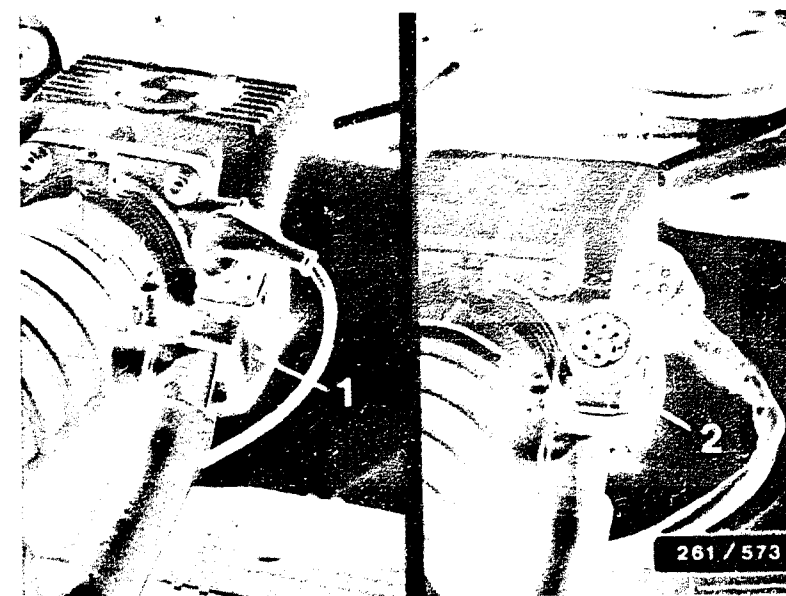
\*) Number in brackets applies to motor vehicles with electronic transmission control.

N>

\* Resistance value remains constantly on approx. 0  $\Omega$  (full-load contact does not open):  
Replace throttle-valve switch.

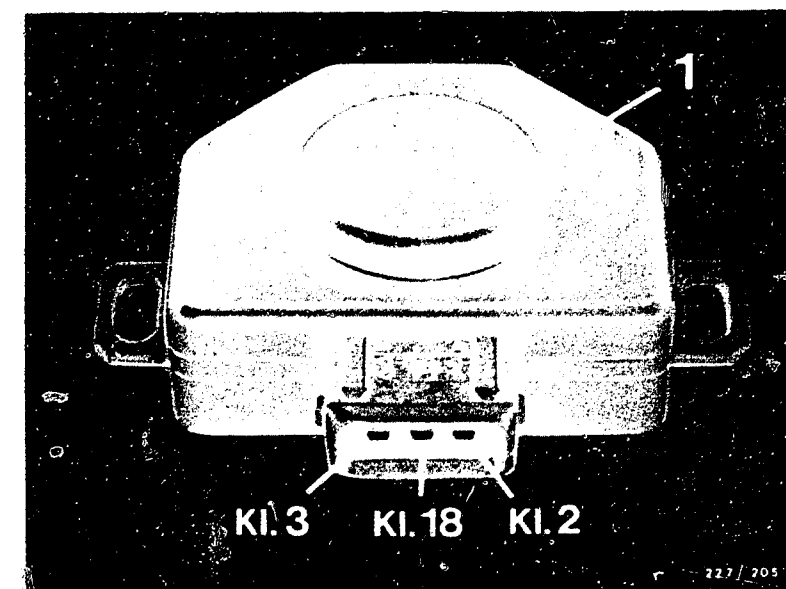
\* Full-load contact does not close (reading remains constantly on infinity  $\Omega$ ):  
Check whether throttle valve is mechanically capable of opening fully.  
If mechanical system is O.K., replace throttle-valve switch.

N o t e :  
Full-load contact cannot be adjusted. If idle contact is correctly set, then the setting of the full-load contact is likewise correct.



1 = Throttle-valve switch with manually shifted transmission  
2 = Throttle-valve switch (with pot) with electronic transmission control

1 = Throttle-valve switch in the case of manual transmission



Continued on next picture page

TROUBLE-SHOOTING PROGRAM ( 6 ) CONTINUED ( 1 )

V

Use ohmmeter to check following leads for open-circuit:

From control unit, term. 53 to throttle-valve switch, term. 3(5)\* and from throttle-valve switch, term. 18(4)\* to ground.

Set values: Approx. 0  $\Omega$

Check plug for corrosion and loose contact.

It must not be possible to push back contacts.

Are set values attained?  
Contacts O.K.?

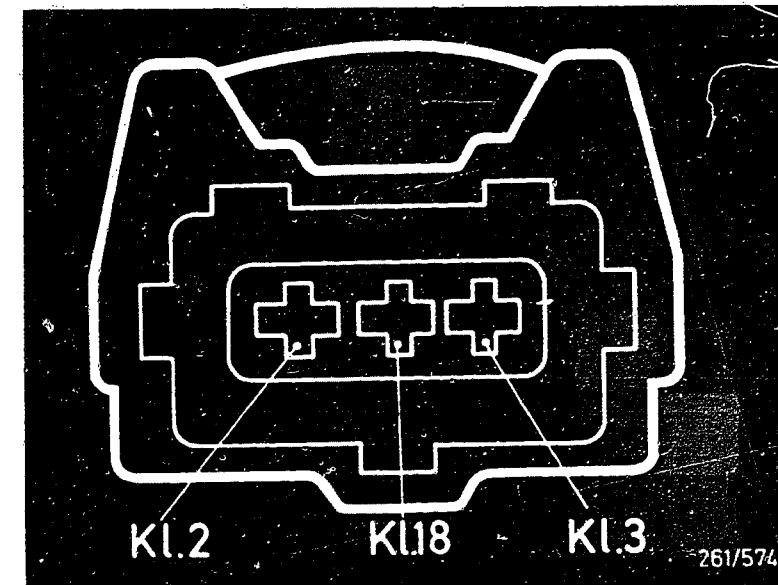
\* Values in brackets apply to motor vehicles with electronic transmission control.

N>

Repair defective lead/plug.

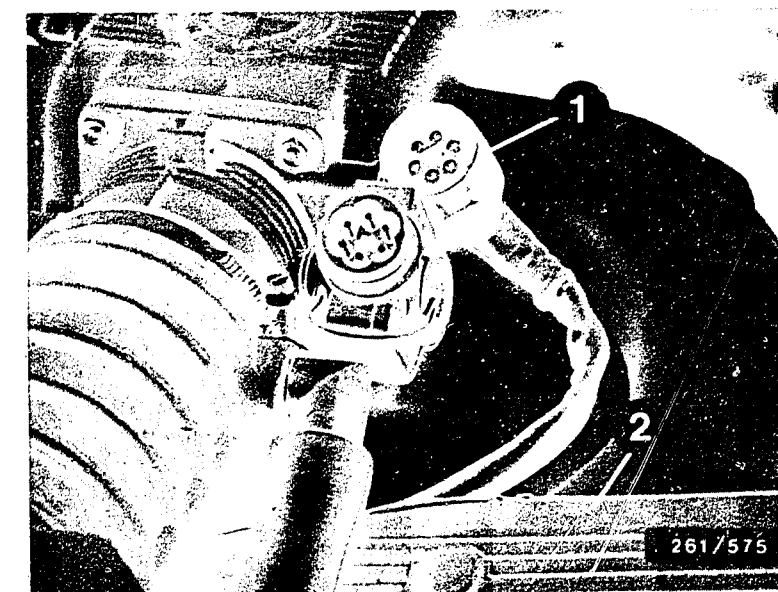
V

Return to trouble-shooting chart B03



Throttle-valve-switch plug

1 = Throttle-valve-switch plug in vehicles with electronic transmission control (Full-load contact: term 5 and term.4)



# TROUBLE-SHOOTING PROGRAM ( 7 )

## Check air-intake system

Check whether hoses of air-intake system are correctly connected, not kinked or damaged.

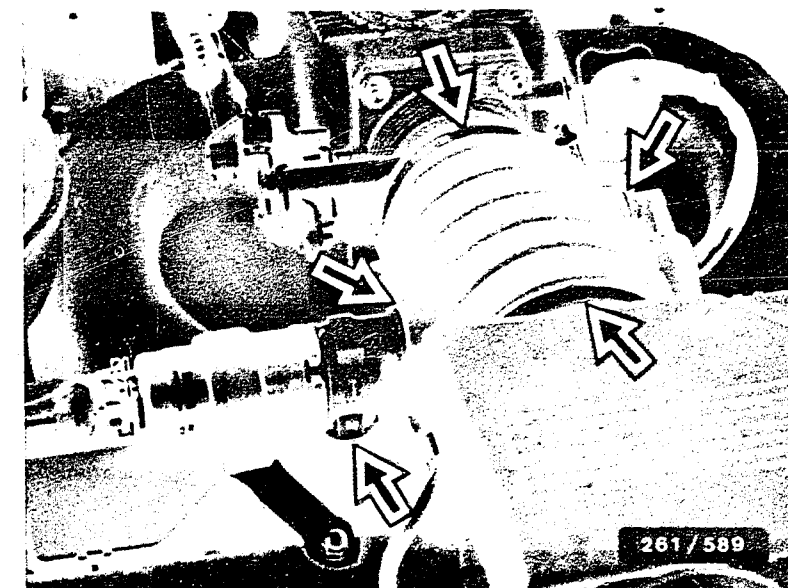
Check whether oil dipstick has been inserted as far as it will go and whether the seal on the oil filler-neck cap is O.K.

With catalytic-converter models, check also that the tank-ventilation system (if applicable) is not leaking (visual examination).

Are all hoses O.K.?

N>

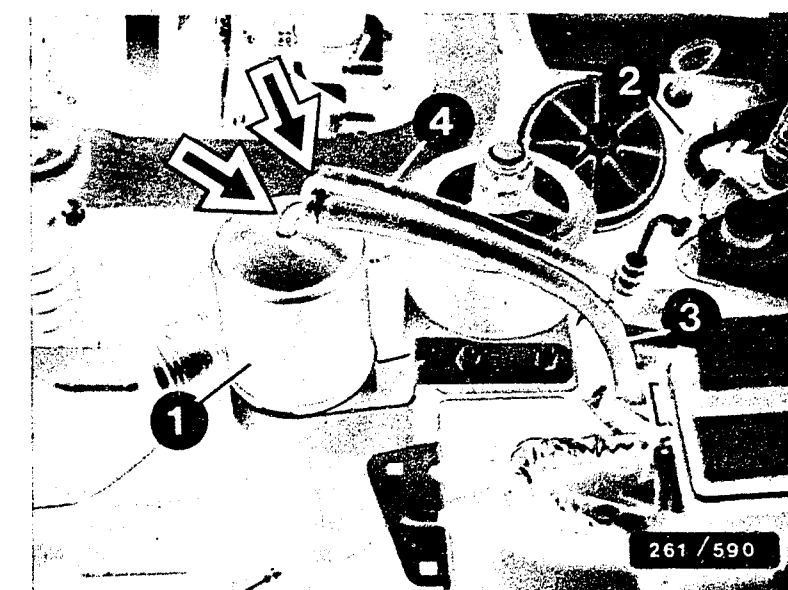
Replace hoses if necessary. Eliminate leaks by means of new seals or by retightening the hose clamps.



Arrow = Sealing points of air-intake system

- 1 = Active-carbon canister
- 2 = Tank bleeder valve
- 3 = Bleeder hose (to tank)
- 4 = Hose to tank bleeder valve

Arrows = Sealing points on active-carbon canister



Continued on next picture page

# TROUBLE-SHOOTING PROGRAM ( 7 ) CONTINUED ( 1 )

Leakage test of the air-intake system.

Seal exhaust tail pipe.  
Unscrew hose from air-flow sensor to air-filter housing and seal air-flow-sensor duct.

Detach hose from crankcase vent. Seal opening to crankcase.  
Open throttle valve fully.

Blow air (0.3 bar gauge pressure) with compressed-air gun into intake manifold.  
Spray all sealing points with leakage detection spray or brush with soapy water.

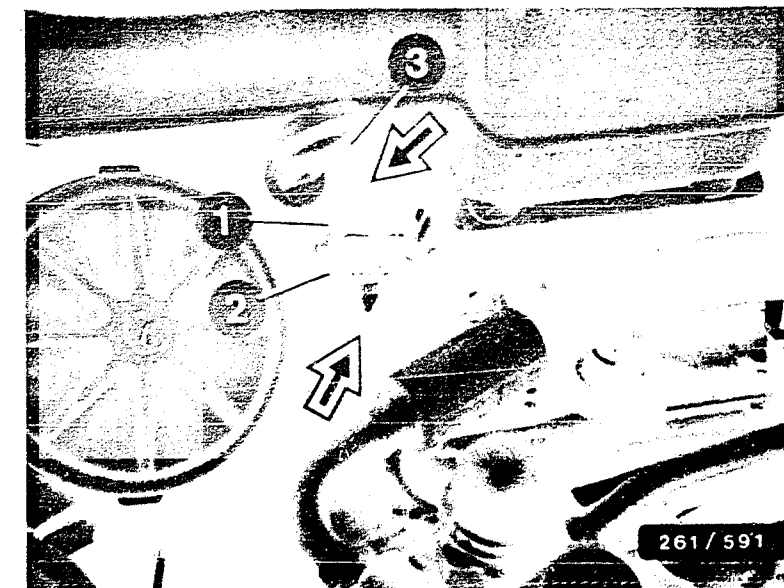
Bubbles or foaming indicate leakages.

Are all points airtight?

N>

Eliminate leaks by means of new seals or by retightening the hose clamps.

Leaks may also occur at the following points: oil dipstick not securely inserted, defective seal at oil filler-neck cap etc.



- 1 = Tank bleeder valve
- 2 = Connector
- 3 = Hose to intake manifold
- Arrows = Sealing points on tank bleeder valve

Return to trouble-shooting chart B03



# TROUBLE-SHOOTING PROGRAM ( 8 )

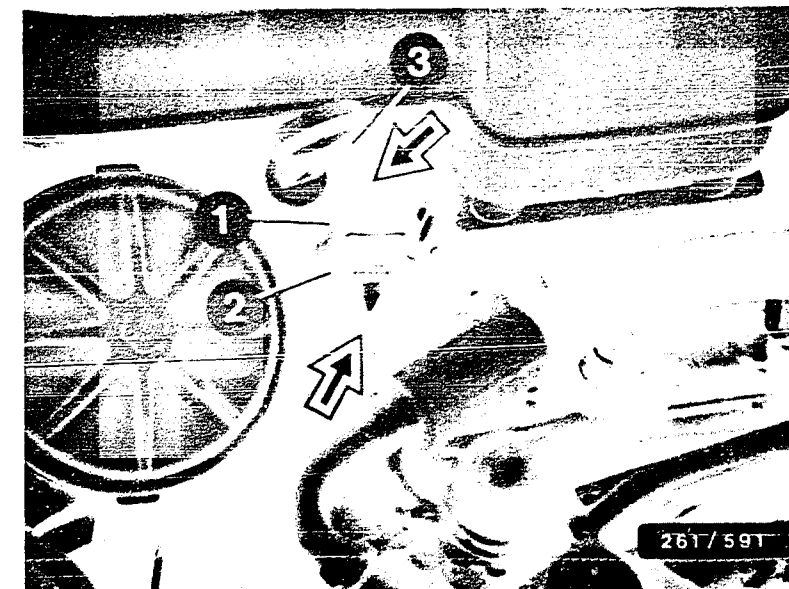
Check tank-ventilation system.

Check visually whether hoses of tank-ventilation system are correctly attached, not bent or damaged.  
Check whether hose connections at intake manifold, tank bleeder valve, active-carbon canister and fuel tank are leak-tight.

Are all hoses and connections O.K.?

N>

Replace defective hoses as necessary.  
Eliminate leakages by tightening hose clamps.



1 = Tank bleeder valve  
2 = Connector  
3 = Hose to intake manifold  
Arrows = Sealing points on tank bleeder valve

1 = Active-carbon canister  
2 = Tank bleeder valve  
3 = Bleeder hose (to tank)  
4 = Hose to tank bleeder valve  
Arrows = Sealing points on active-carbon canister



Continued on next picture page

# TROUBLE-SHOOTING PROGRAM ( 8 ) CONTINUED ( 1 )

Function and freedom  
from leaks of tank-ventilation valve. N>

\*Valve must be noticeably  
clocked with engine running.

\*Remove tank-ventilation  
valve to check for leaks.  
Connect vacuum pump (e.g.  
Mityvac) to valve connection  
on intake manifold end.

1. Valve continuity when no  
current applied, i.e.  
no build up of vacuum possible.
2. Actuate valve with battery  
voltage (12 V); make use of  
connection lead  
KDJE-7450/70.

Generate vacuum of approx.  
0.5 bar. If tank-ventilation  
valve is intact, the vacuum  
slowly decreases. Approximate  
value: Drop in vacuum from  
0.5 to 0.25 bar at 12 V  
in approx. 10 s is  
permitted.

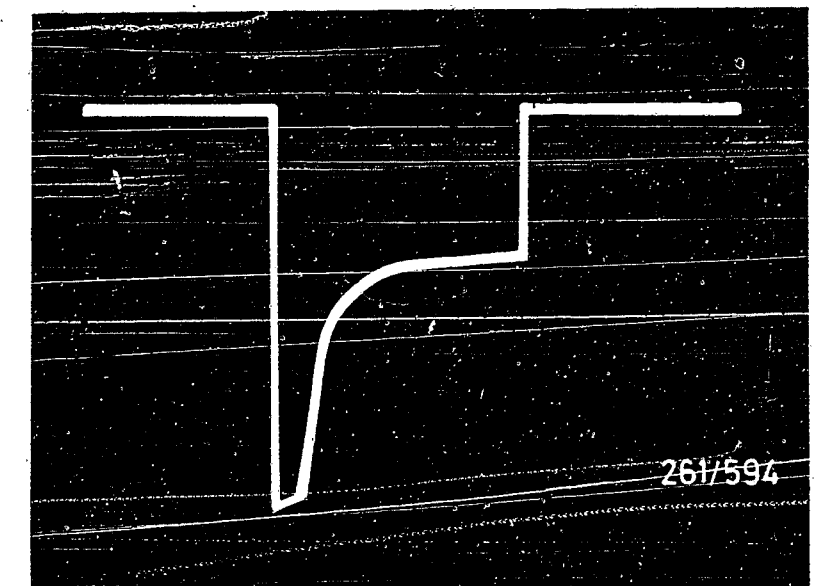
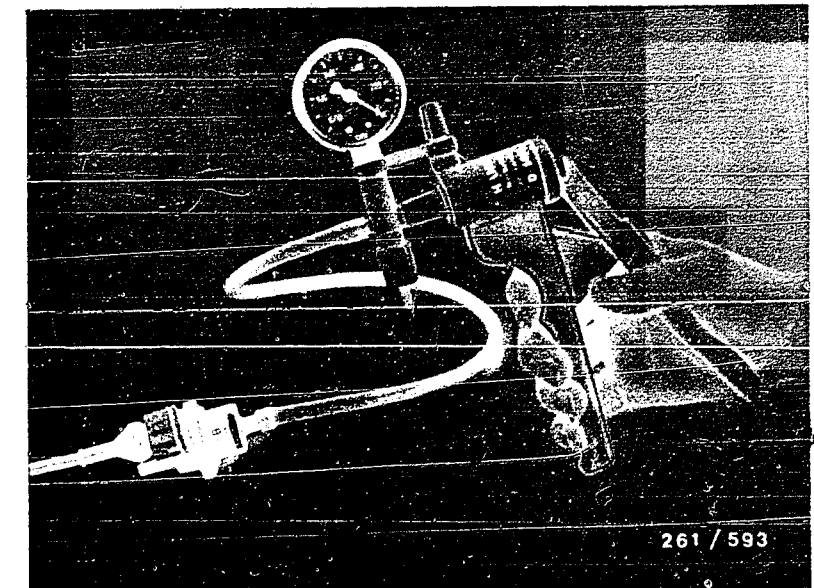
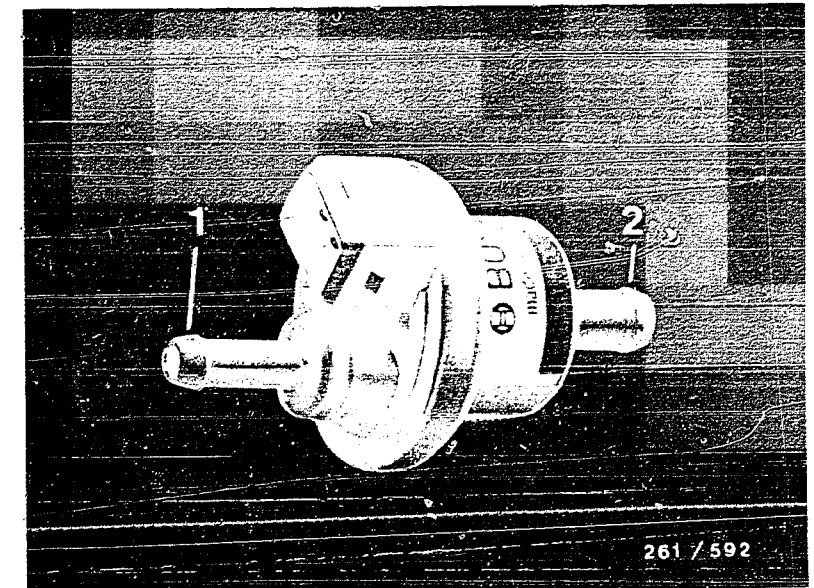
3. Valve deenergized.  
Seal other connection.  
Build up vacuum of approx.  
0.5 bar.  
There must be no decrease  
in vacuum.

Does valve satisfy all points?

Return to trouble-shooting chart  
B03

1. Detach plug from  
valve.  
Check internal resistance:  
SET VALUE see brief  
instructions.  
If set value is not  
obtained, replace tank  
bleeder valve, otherwise  
continue test with 2.

2. With the aid of test lead  
1 684 463 093 test  
activation of valve (on/off  
ratio is dependent on  
engine speed and load).  
Pulses must be visible  
at idle on oscilloscope  
(special input)  
(bottom picture).  
If no signal, check plug  
and lead to control unit,  
otherwise control  
unit is defective.



## TROUBLE-SHOOTING PROGRAM ( 9 )

V

Check idle adjuster.

\*Measure winding resistances directly at idle adjuster:

SET VALUES:  
see brief instructions

\*Test leads from control unit term.4 and term.22 to idle adjuster term.1 and term.3 (external connections) and from central connection of idle adjuster (term.2) and term.87(+) for continuity.

Check plug for corrosion and loose contact.  
It must be impossible to push back contacts.

\*Slider of idle adjuster adjuster must not jam or catch.

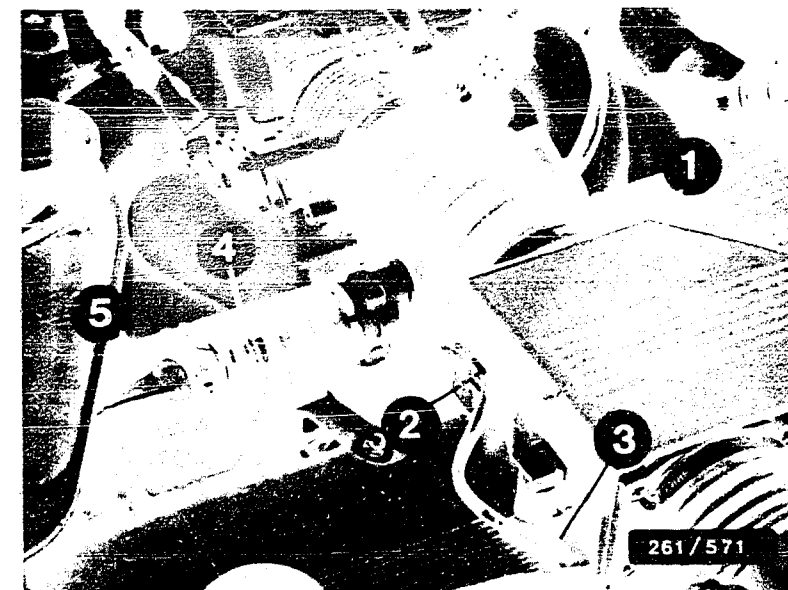
Winding resistances,  
leads and slider O.K.?

N>

\*Winding resistances outside tolerance range:  
Replace idle adjuster.  
Pay attention to dir. of flow

\*Ensure that leads and plug-in connection are O.K.

\*Slider mechanically defective:  
Replace idle adjuster.  
Pay attention to dir. of flow



- 1 = Air-flow sensor
- 2 = CO adjusting screw
- 3 = Connector to air-flow sensor
- 4 = Idle actuator
- 5 = Connector

Y

V

Continued on next picture page

# TROUBLE-SHOOTING PROGRAM ( 9 ) CONTINUED ( 1 )

Check energization of idle actuator.

Switch on ignition.  
Idle actuator is pulsed by the control unit and vibrates (feel by hand).

Idle actuator vibrating?

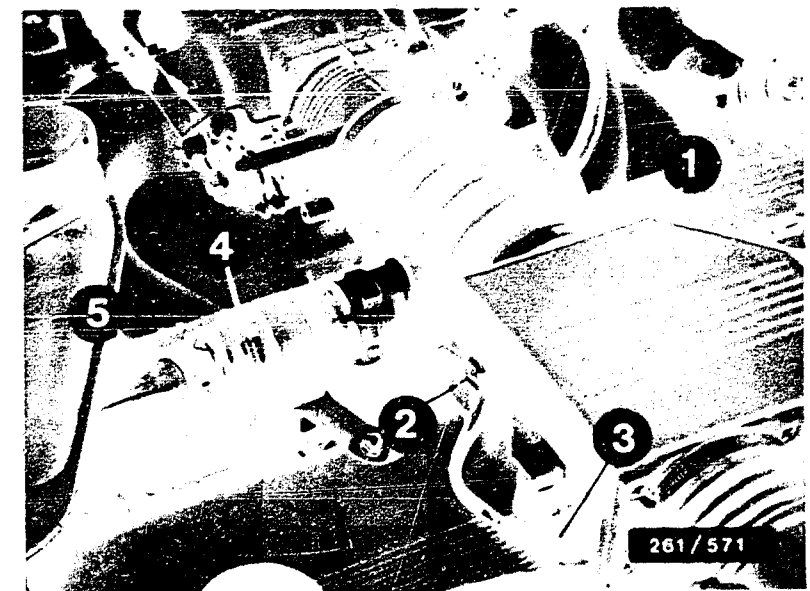
N>

Measure signals at idle adjuster (two windings):

\*Push back rubber sleeve on three-pin plug to idle adjuster.  
Connect motortester (special input) with test prods:  
Red clip to central terminal, black clips consecutively to the outer terminals.

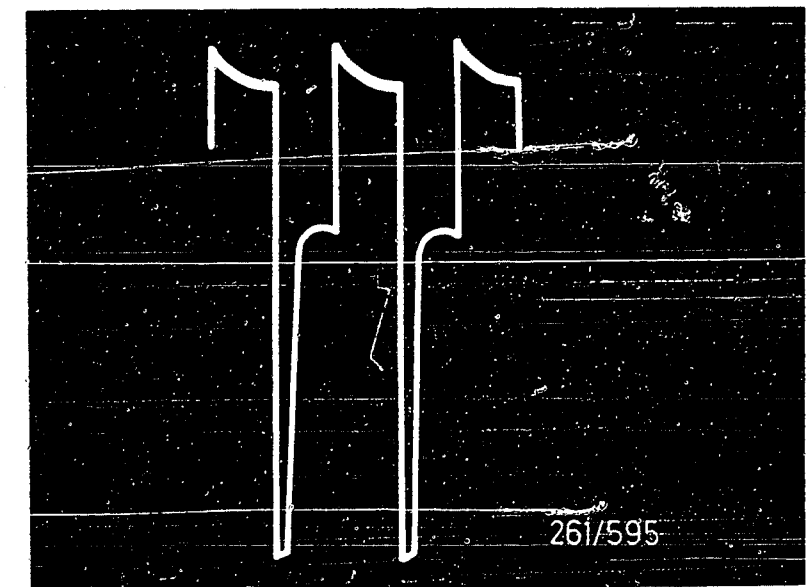
Switch on ignition.  
If correctly connected, signals become visible on the oscilloscope (bottom picture)

If no signals visible:  
\*Check leads to control unit for continuity.  
\*Replace control unit.



- 1 = Air-flow sensor
- 2 = CO adjusting screw
- 3 = Connector to air-flow sensor
- 4 = Idle actuator
- 5 = Connector

Signals at idle adjuster



Return to trouble-shooting chart B03

# TROUBLE-SHOOTING PROGRAM (10)

Check overrun cut-off:

Lift cover over injection valves.  
Set motortester to special input.  
Connect black clip to vehicle ground.  
Connect red clip with suitable test prod initially to one pin of an injection-valve plug.  
Let engine run.  
Note:  
As the terminal assignment of the injection-valve plugs is not standard, the negative lead of the injection valve must be determined.  
If no injection pulses can be seen, connect red clip to other pin of injection-valve plug.  
Run engine at 3000 min<sup>-1</sup>.  
Injection signals can be seen (see top picture).

Suddenly release accelerator.

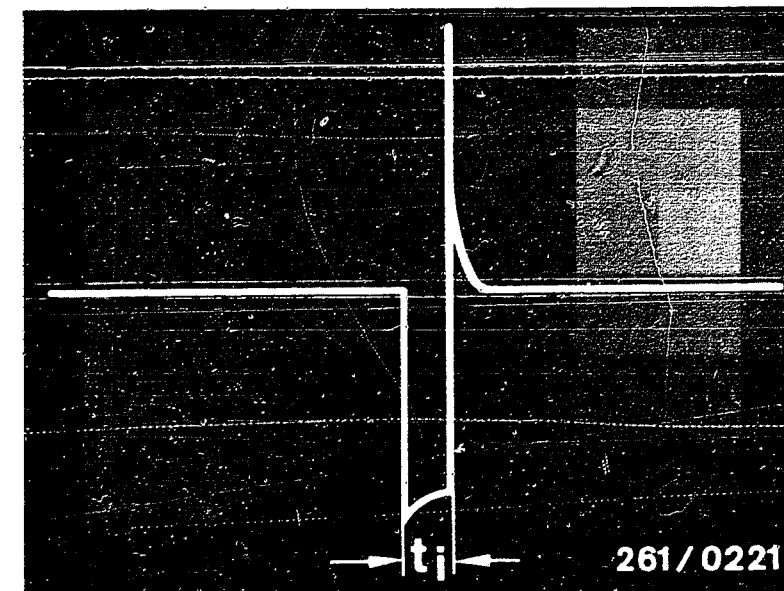
SET VALUE:

Injection signals are suppressed with decreasing engine speed and cut in again above idle speed.

Set value O.K.?

N>

- \* Repeat test.
- \* Check idle contact in throttle-valve switch.
- \* Control unit defective.



Injection signal  
 $t_i$  = Duration of injection

Return to trouble-shooting chart  
B03

# TROUBLE-SHOOTING PROGRAM (11)

Check ignition coil.

Visual check:

Remove hood from ignition coil and check that plug (top picture) is in position and that no sealing compound has escaped.

Electrical test:

Measure resistance of ignition coil on primary side (term.15 and term.1; take resistance of test lead and test prods into account) and on secondary side (term.1 and term.4):

SET VALUES:

see brief instructions

Plug in position and no sealing compound escaped?

Resistance values O.K.?

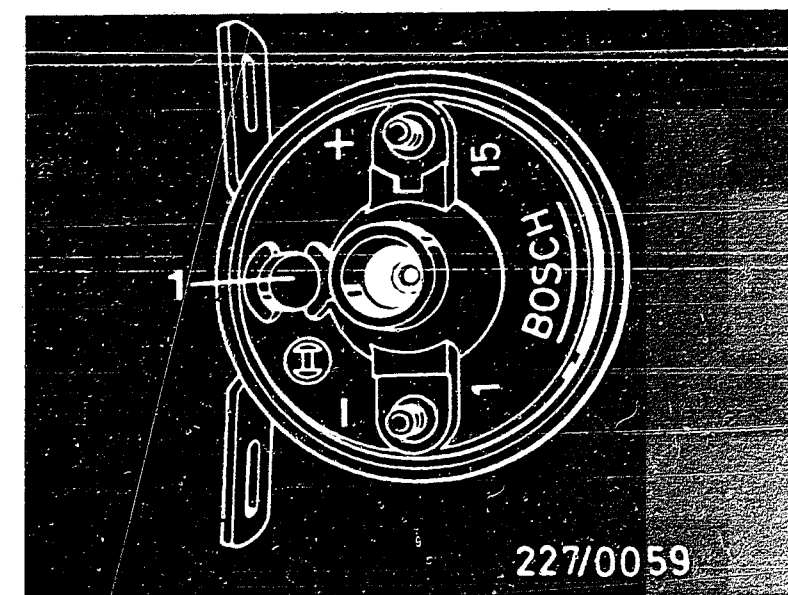
N>

1. No plug or sealing compound oozed out:

Renew ignition coil and control unit.

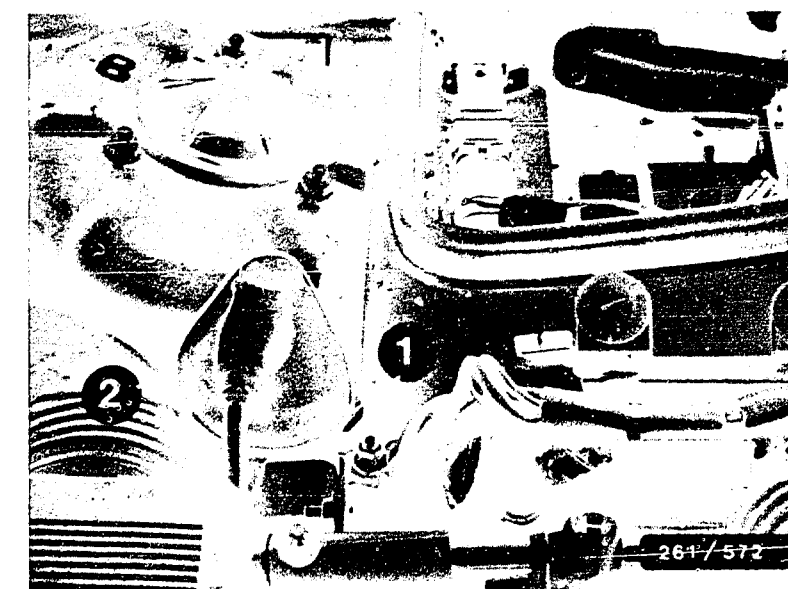
Check lead from ignition coil, term. 1 to control unit, term. 1 for short-circuit to ground and continuity.

2. Resistance values not within tolerance:  
Renew ignition coil.



1 = Plug

2 = Ignition coil



Return to trouble-shooting chart B03

# TROUBLE-SHOOTING PROGRAM (12)

V

Check primary signal with  
oscilloscope:

N>

Connect oscilloscope to ignition  
coil.

Connect Motronic control  
unit.

Disengage gear and start  
engine.

SET VALUE:

Primary signal must be  
present (see top picture).

Primary signal present?

Y

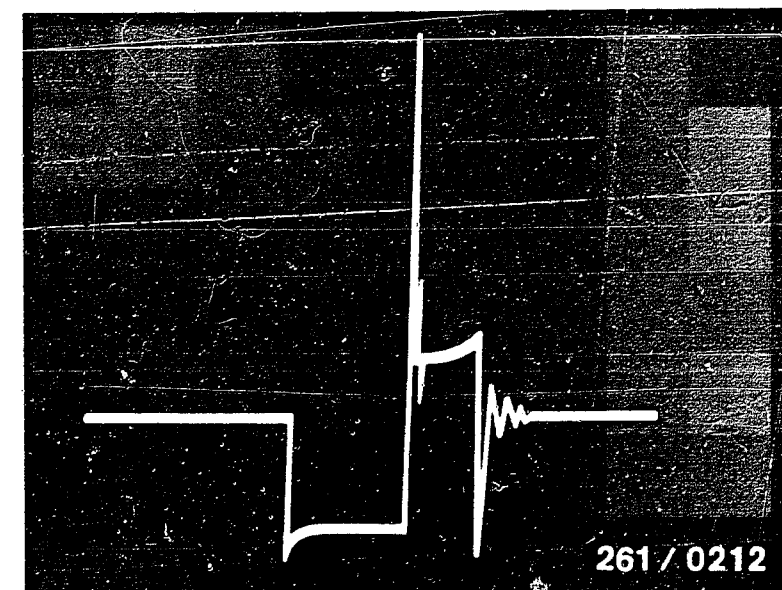
V

Continued on next picture page

+ Check lead from ignition  
coil term.1 to control  
unit term.1 for continuity.

+ If lead O.K., replace  
control unit.

Requirement: voltage supply  
for control unit available  
and engine-speed/  
reference-mark signal  
O.K. and ignition coil  
checked.



Primary signal

# TROUBLE-SHOOTING PROGRAM (12) CONTINUED ( 1)

Check secondary patterns of all cylinders and interference-suppression resistors.

SET VALUES for interference-suppression resistors:  
see brief instructions

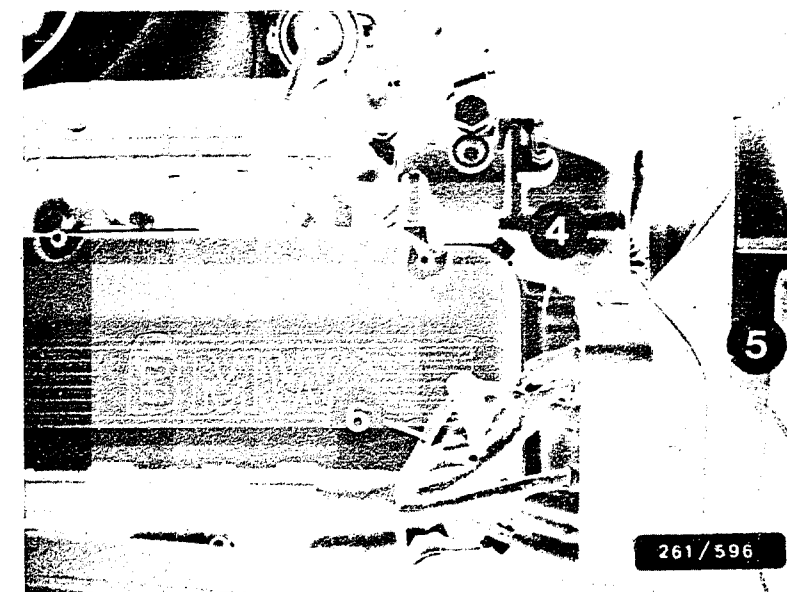
Secondary patterns and interference-suppression resistors O.K.?

N>

\*Outside and/or inside of distributor cap oil fouled? Scorch marks visible?

\*Check interference-suppression resistors, ignition cables and spark plugs.

\*When plugging on the ignition cables, note the cylinder numbers.  
Do not forget hood and screening cover.



4 = High-voltage distributor  
5 = Hood  
6 = Ignition cables

Return to trouble-shooting chart B03

F21

<=>

F22

<=>



# TROUBLE-SHOOTING PROGRAM (13)

Check ignition point.

Connect motortester.

Warm up engine to operating temperature  
(engine oil above 60° C).

Switch off all loads.

Use TDC pickup for spark-advance-angle measurement.

Idle speed must be at specified set value (see brief instructions), otherwise a different spark-advance angle is indicated.

SET. VALUE for spark-adv. angle:  
see brief instructions

Is set value obtained?

N>

+ Idle speed correct?

+ Control unit defective.

Return to trouble-shooting chart  
B03

F23

<==>

F24

<==>

## TROUBLE-SHOOTING PROGRAM (14)

Check exhaust gas (CO):

Connect exhaust-gas analyser.  
Exhaust-emission measurement  
and adjustment are not necessary  
on vehicles with a catalytic  
converter, since the exhaust-  
emission value is corrected by the  
adaptive lambda closed-loop control.

Engine at operating temperature,  
switch off loads,  
set automatic transmission to  
N or P.

Allow engine to idle.

SET VALUES:

See brief instructions.

Set values O.K.?

N>

\*Possibility of adjustment  
of mixture (CO) at bypass  
in air-flow sensor (top  
picture):

Remove plug in air-flow  
sensor.

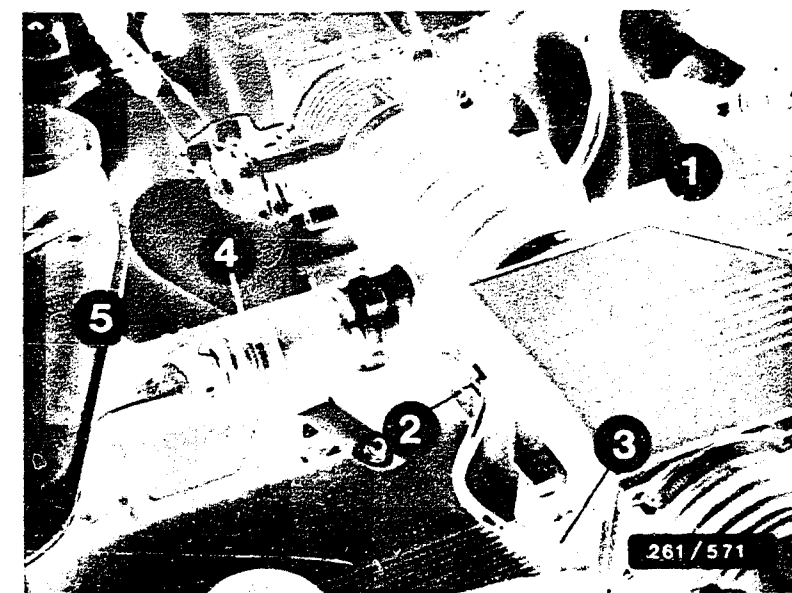
Turn idle-mixture-adjusting  
screw clockwise, CO rises

Turn idle-mixture adjusting  
screw counterclockwise, CO falls

If CO cannot be adjusted and  
mixture is too lean, repeat  
leakage test of suction  
system.

After adjustment, insert  
new plug with 13 mm diameter.  
(See service-parts list)

\*See trouble-shooting chart  
for other possible faults.



- 1 = Air-flow sensor
- 2 = CO adjusting screw
- 3 = Connector to  
air-flow sensor
- 4 = Idle actuator
- 5 = Connector

Return to trouble-shooting chart  
B03

# TECHNICAL BULLETIN

PARTS SET FOR SOLENOID-OPERATED

INJECTION VALVES 0 280 150 2..

AND PRESSURE REGULATORS 0 280 160 2..

13...39  
VDT-I-261/102 En  
6.1983

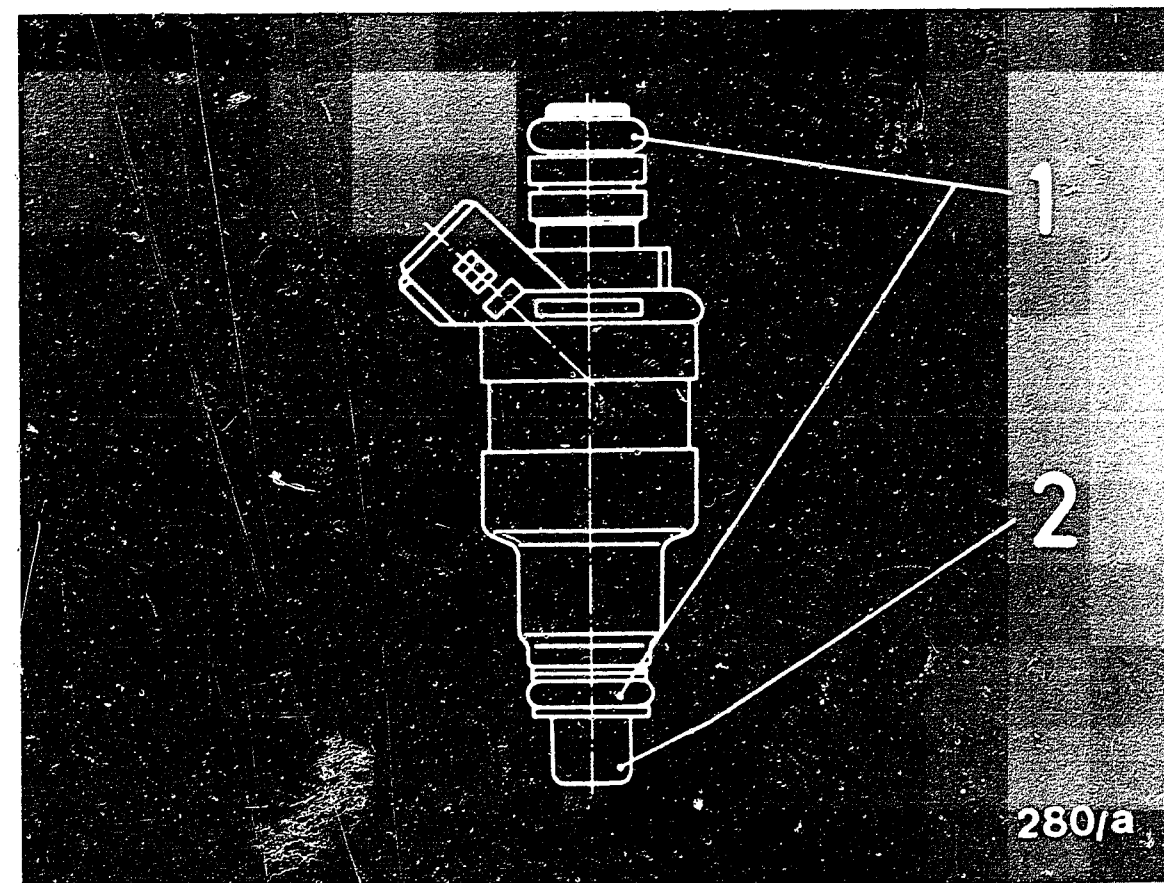
supersedes 8.82 edition

A common parts set is available for the Motronic solenoid-operated injection valves and pressure regulators with the new method of connection.

Since the above-mentioned parts are subjected to extreme temperature stress, they should be exchanged for new parts whenever servicing is carried out.

"Unmetered air" sucked in through injection-valve seals which are not tight is a frequent case for servicing.

The parts set has the part number 1 287 010 704 and is listed in the service-parts microcard under solenoid-operated injection valves (see EE 00 under 0 280..).



1 = O-ring

2 = Protection sleeve

Contents for 1 injection valve:

2 x O-ring

1 x Protection sleeve, yellow

Contents for pressure regulator:

1 x O-ring

1 x Supporting plate

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Technical After-Sales Service (KH/VKD 2)

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# TECHNICAL BULLETIN

## PLUG CONNECTORS FOR JETRONIC COMPONENTS

28  
VDT-I-280/111 En  
11.1984

Parts sets supersedes Ed. 11.1982

Parts sets are available for the replacement  
of Jetronic plug connectors, comprising:

- \* Plug-connector housing
- \* Protective cap (rubber sleeve)
- \* Contact springs

These parts are listed on microcard EE...\*

- \* See microcards EE00 and 0 280 ..

- \* Plug, black, 2-pole,  
parts set 1 287 013 002 cable connector  
in conjunction with socket, 2-pole.

- \* Socket, black, 2-pole,  
parts set 1 287 013 001 for e.g.

Temperature sensor 0 280 130 0..  
Auxiliary-air device 0 280 140 ..  
Thermo-time switch 0 280 130 2..  
Start valve 0 280 170 ..  
Warm-up regulator 0 438 140 ..

- \* Socket, gray, 2-pole,  
parts set 1 287 013 003 for:

Injection valve 0 280 156 ..

- \* Socket, black, 3-pole  
parts set 1 237 000 039 for:

Throttle-valve switch 0 280 120 ..

- \* Socket, black, 5-pole,  
parts set 1 287 013 006 for:

Air-flow sensor 0 280 20. .. (LE version)

- \* Socket, black, 6-pole,  
parts set 1 287 013 004 for

Air-flow sensor 0 280 200 ..

- \* Socket, black, 7-pole,  
parts set 1 287 013 005 for:

Air-flow sensor 0 280 20. ..

Air-mass sensor 0 280 211 ..

- \* Wiring-harness plug connector, black, 25-pole,  
parts set 1 287 013 009 for:

Control unit 0 280 0..

- \* Wiring-harness plug connector, black, 35-pole,  
parts set 1 287 013 008 for:

Control unit 0 280 0..

The contact springs (minitimers) are also  
available individually under part number  
1 284 477 026.

The plug-connector housings are available  
only in the stated colors.

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## S E R V I C E   I N F O R M A T I O N

### VARIANT-CODED MOTRONIC CONTROL UNITS

Vehicles: passenger cars  
05.1987

As of 06.86 in the case of 7 series and as of 10.86 in the case of the 6 series (5 and 3 series to follow) BMW has introduced a new generation of Motronic control units.

### N E W

This type of control unit must be programmed to the appropriate vehicle type at KH before delivery to the BG/BD.

### N o t e :

The vehicle will not run with uncoded control units. Damage to the engine is possible with incorrectly coded control units.

In addition to the 10-digit part number, KH also requires the following details:

- (1) = Part number, 10-digit
- new (2) = Growth number,  
3-digit (001 bis 999)
- new (3) = Variant control word, alphanumeric  
4-position

### Example:

- (1) = 0 261 200 150
  - (2) = 002
  - (3) = C05E
- (refer also to illustrations on following pages)

## I M P O R T A N T :

Growth number (2) and variant control word (3) must be stated additionally when ordering the control unit.

The control unit cannot be programmed without these details.

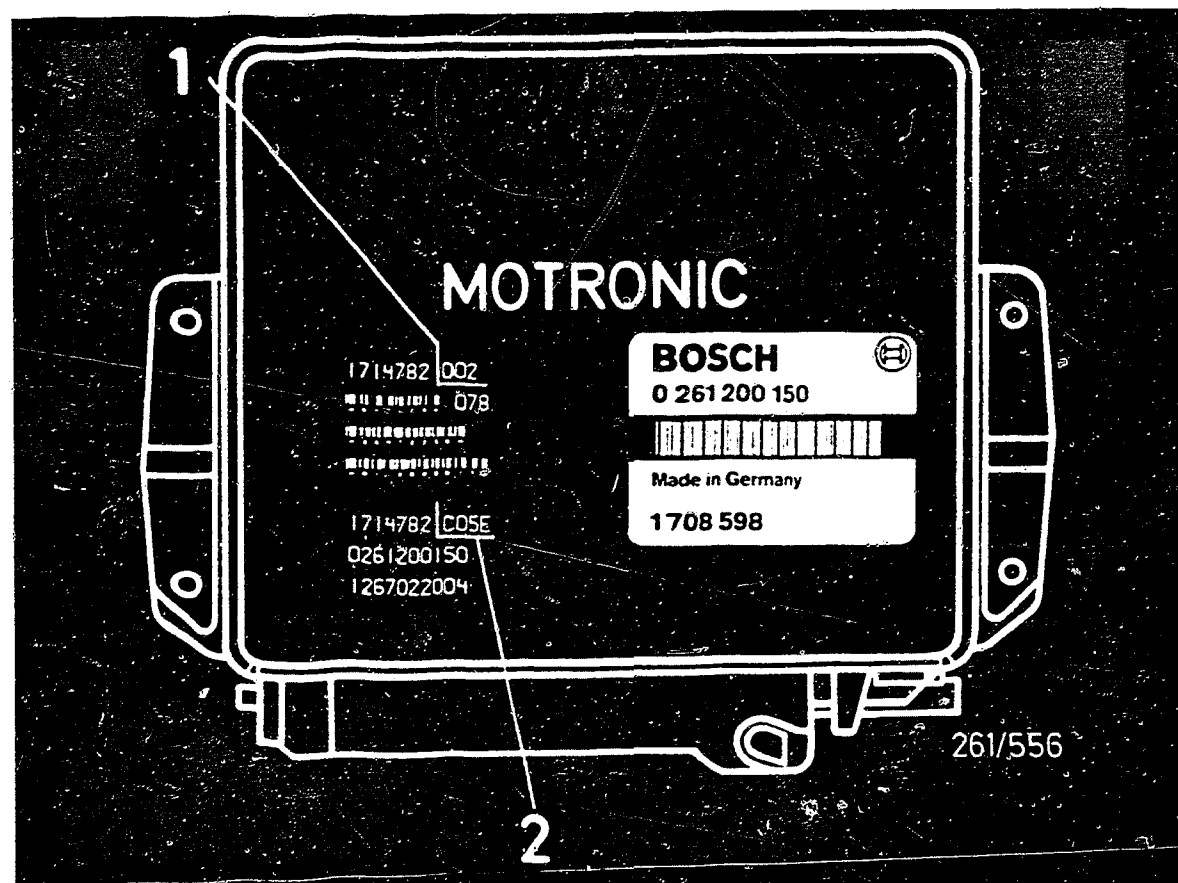
### Types of control unit

0 261 200 150, old version,      FD 645-651  
0 261 200 150, new version,    as of FD 652

0 261 200 151  
0 261 200 152  
0 261 200 153  
0 261 200 154

### Delivery procedure

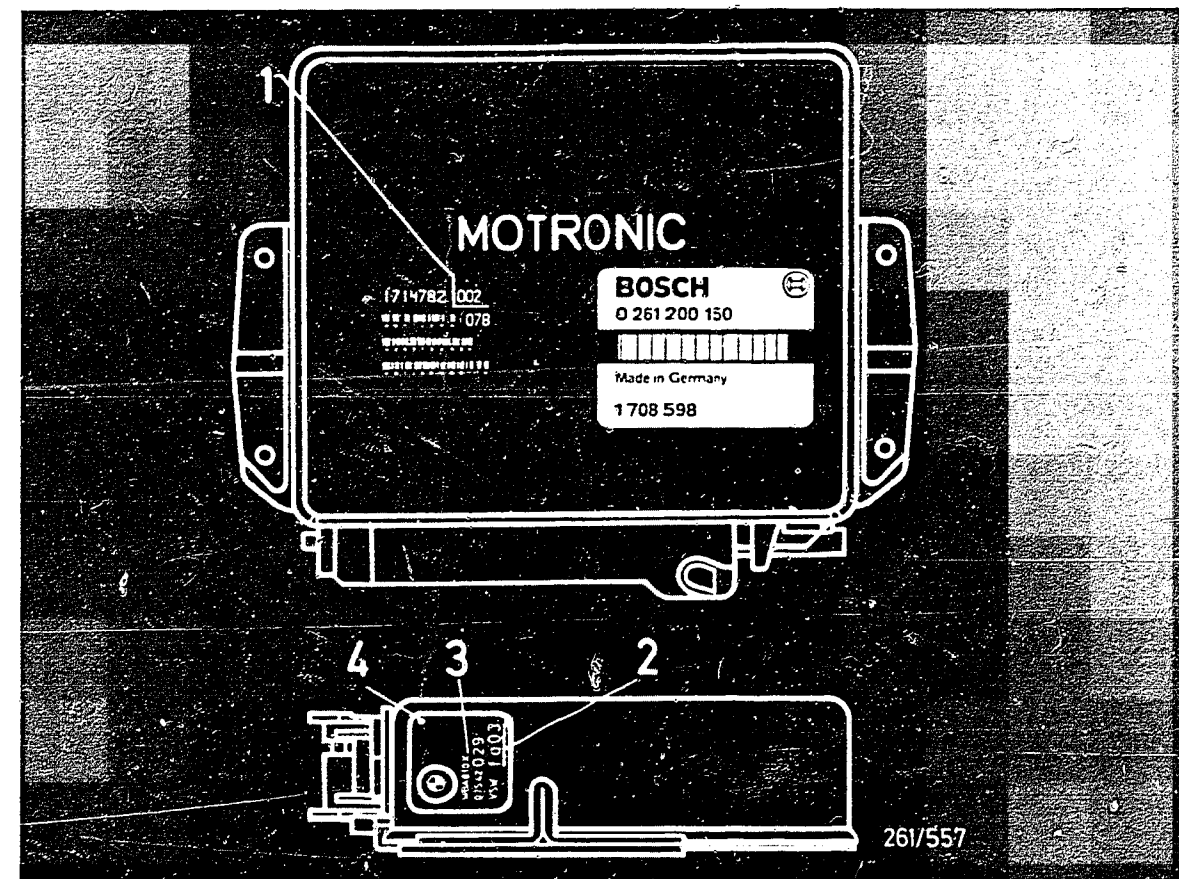
- The variant-coded control units are stored at KH as central store parts.
- Delivery direct to orderer via overnight dispatch (within Fed. Republic of Germany).
- Delivery is delayed by one day due to the need to program the control units at KH.



- 1 = Growth no. 3-digit  
2 = Variant control word (code)  
alphanumeric, 4-position

#### Motronic with variant coding

Control unit (only 0 261 200 150) old  
version, FD 645-651.



- 1 = Growth no. 3-digit  
2 = Variant control word (code)  
alphanumeric, 4-position  
3 = Chassis no.  
4 = BMW sticker

#### Motronic with variant coding

Control units new version, as of FD 652.

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Zeilenanzahl \* -2 \* Unterschied!!

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